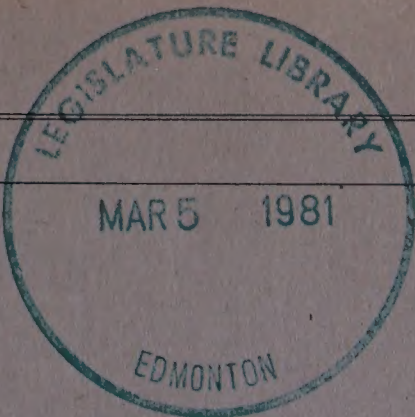


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V4/5



# The Province of Alberta

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## PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions  
relating to the proposed Export of Natural Gas from the Province of Alberta.

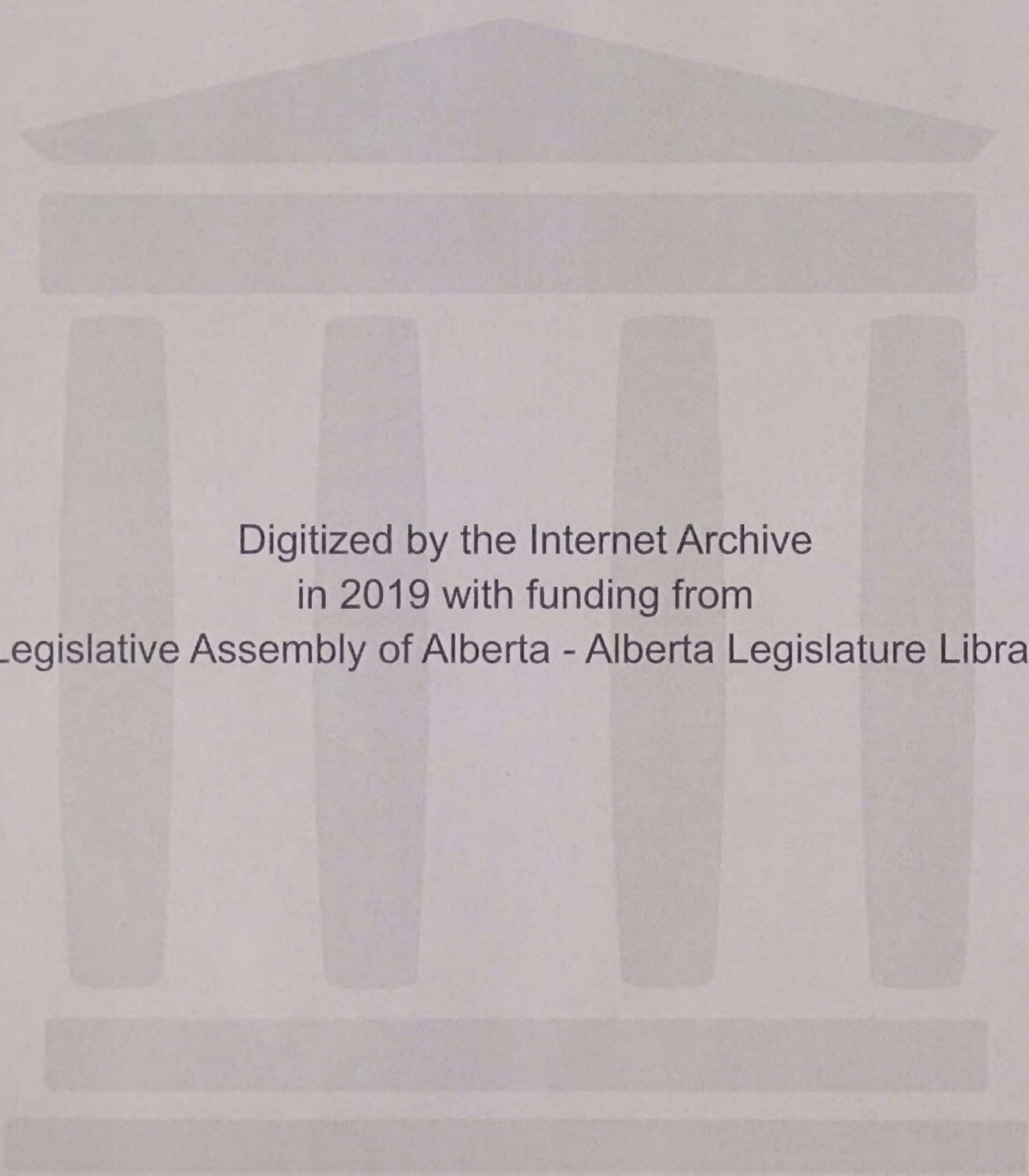
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I. N. McKinnon Esq., Chairman  
D. P. Goodall Esq.  
Dr. G. W. Govier

**Session:**      SEPTEMBER 17th, 1951.

**Volume** 5





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# I N D E X

VOLUME 5.

17 September 1951.

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THE CHAIRMAN:  
ton available?

Mr. McDonald, is Mr. Hethering-

MR. McDONALD:

Yes.

CHARLES R. HETHERINGTON

(recalled) already sworn,

MR. McDONALD:

Answer other counsel, Dr.

Hetherington.

CROSS-EXAMINATION BY MR. STEER:

Q Dr. Hetherington, in your Exhibit 5 on page 5, I take it that you used there simply Dr. Nauss's figures?

A Yes.

Q And you regard those figures as indicating the marketable gas?

A Yes.

MR. R.L. FENERTY: Mr. Chairman and Members of the Board, with your permission and my learned friend's permission, on behalf of Canadian Gulf Oil Company I would like to speak to the Board on the matter of keeping Dr. Hetherington available for cross-examination on behalf of Canadian Gulf Oil Company tomorrow. It was thought until apparently this morning that the Doctor would be available both today and tomorrow for cross-examination and scheduled preparation for cross-examination accordingly was planned to have us prepared to cross-examine



Information of Mr. [Name] by Mr. [Name]

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C. R. Hetherington - Cr. Ex. by Mr. Steer.

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tomorrow. I am speaking now because rather than waiting through the present cross-examination I thought time might well be spent on preparing for that cross-examination rather than any further delay. I spoke to Dr. Hetherington just before this Hearing and he advised me that he wishes to be away on a plane at 11:15, which probably means tomorrow morning, which means a maximum of one hour available tomorrow morning. I spoke to Mr. McDonald about the matter too. I do not see how we can be prepared to cross-examine this morning. I would hope that the cross-examination on behalf of Gulf could be completed within an hour tomorrow morning. I would not care to guarantee that that is so, but I would ask that Mr. Hetherington be made available tomorrow as the Canadian Gulf Company has some interest in Pincher Creek, to which reference has been made in the plan, and I would like permission to cross-examine Mr. Hetherington tomorrow morning at the opening in an effort to accommodate him possibly in getting him away in time for his plane. I mention it now rather than later, as I say, because I want to take the time during the morning to prepare.

MR. McDONALD: Well, Dr. Hetherington will be available first thing up to say a quarter to eleven or something of that kind.

MR. STEER: Probably we might start at 9 o'clock.

THE CHAIRMAN: I was going to suggest that.

MR. McDONALD: That would be agreeable, sir.  
Thanks very much.

MR. FENERTY: I am sure we both appreciate







C. R. Hetherington - Cr. Ex. by Mr. Steer.  
Cr. Ex. by Mr. Nolan.

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the accommodation.

Q MR. STEER: I have just one other question, Dr. Hetherington. On page 9, as I understand your plan, either in the first place, as stated in paragraph 4, certain looping is required and then a new line from Pincher Creek or a line to Macleod with moving of sections to the 16-inch line to Calgary. Now, that is pretty expensive construction, I take it?

A Well, it would cost money, yes.

Q It would cost a lot of money. I have not made the computation on the basis of your figures but it would be millions of dollars?

A Yes, that is right. It takes millions of dollars to transport extra millions of cubic feet.

Q And under your plan, when would that expenditure be made?

A The first expenditure would be required in 1958, according to the Board's estimates of needs of the Calgary system for additional gas.

Q And under your plan, by whom would the expenditure be made?

A It would be made by the Gas Company.

Q I see. That is all, thank you.

CROSS-EXAMINATION BY MR. NOLAN:

Q I want to ask Dr. Hetherington a question, if I may, sir. Dr. Hetherington, I am looking at page 5 of Dr. Nauss's report, which is Exhibit 4, where the Peace River area is described, Dr. Hetherington, on page 5.

A Yes.

Q Have you made a study of the deliverability characteristics







C. R. Hetherington - Cr. Ex. by Mr. Nolan.

C. R. Hetherington - Exam. by Mr. C.E. Smith.

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of those fields in that Peace River area?

A Well, I think Mr. McDonald can give you that information. It is my understanding that this initial Hearing was related only to supplying to the Provincial systems of their deficiencies and that the second part of the Hearing would deal with the deliverabilities for the export market.

Q Well, let me put it this way, in your amended application you show a requirement of 70 billion cubic feet per year. That is so, isn't it?

A That is in the 5th year, yes.

Q From this area?

A Yes.

Q Could you tell me approximately how many years these Peace River fields could supply that 70 billion cubic feet per year?

A I will be prepared to take that up with our second phase of this Hearing. I am not prepared to do that right now.

Q All right, thank you.

MR. S.B. SMITH: I have no questions.

EXAMINATION BY MR. C.E. SMITH:

Q I have just one, I think. If I remember correctly, you mentioned, I have forgotten how you phrased it, I think you called it the Montana Power's storage during the course of your direct evidence the other day?

A Yes.

Q I do not know whether you did expand at all on that, but if you did not, would you give me some idea just what your plan is about Montana Power's storage. Is







C. R. Hetherington - Exam. by Mr. C.E. Smith.

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that not some other depleted fields or what?

A Let me put it a different way. The Montana Power Company has various gas fields, particularly in the Cutbank area. There is one field north of Cutbank particularly suited to this type of storage. It is proposed to use that field to store this gas. Now, as you will note from looking at a map, the storage field is in the wrong direction for pipeline storage and it serves simply as production storage to permit uniform production on the Pincher Creek field.

Q And that, of course, would have to be exported, if that be the word, from across the line? I mean, there is no Canadian-Montana Power storage?

A That is correct.

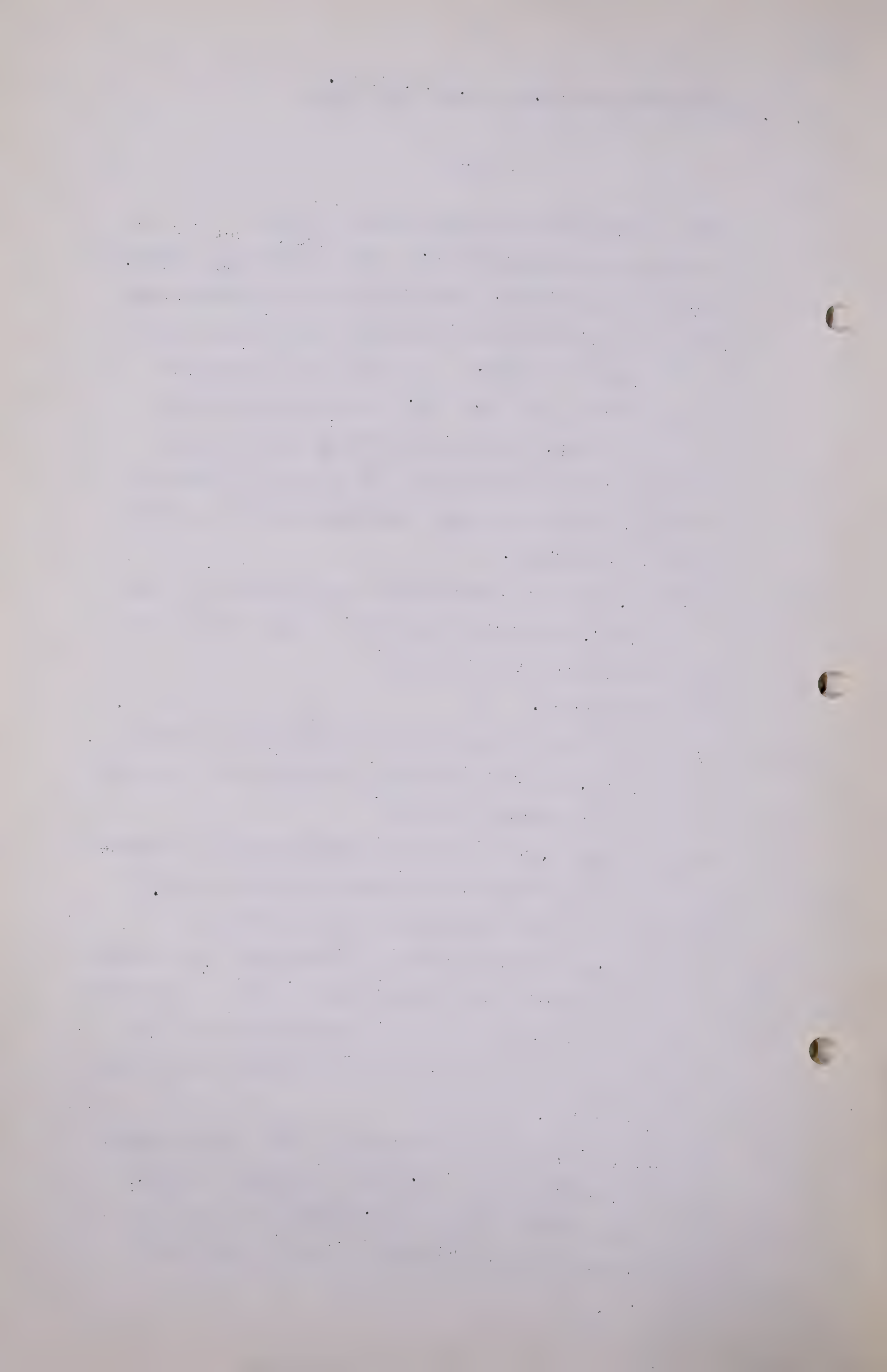
Q And what you have in mind is just across the line and, as you say, in probably the wrong direction for your plans but it is the place to put it?

A That is right, and in our second submission at the second part of this Hearing, we will have a map showing those pipelines from the United States back to Montana.

Q You don't know if anybody has any arrangement with Montana Power to permit all this being done, do you? I would be a little concerned if I were you if Montana Power got a hold of your gas in their storage over there because they want it too.

A Well, sir, this storage I am talking about is an annual in-and-out proposition. It is not a matter of storing gas for any period of time, just putting it in in the summer time and taking that same amount in the winter time.







C. R. Hetherington,  
Exam. by Mr. C.E. Smith.  
Exam. by Dr. Govier.

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Q I wanted to be sure of locality, that is all. There is no doubt where it is from what you have said now.

A It would be in that area or any other suitable storage area.

Q That is all.

Q MR. STEER: Could you tell us anything about the capacity of that storage field, Dr. Hetherington?

A The Montana Power people have that information and I would much prefer if they would put it on.

EXAMINED BY DR. GOVIER:

Q Dr. Hetherington, in connection with the point raised by Mr. Smith, is it correct for the Board to assume that in so far as its impact on Alberta is concerned, the export load factor is 75 per cent?

A That is correct.

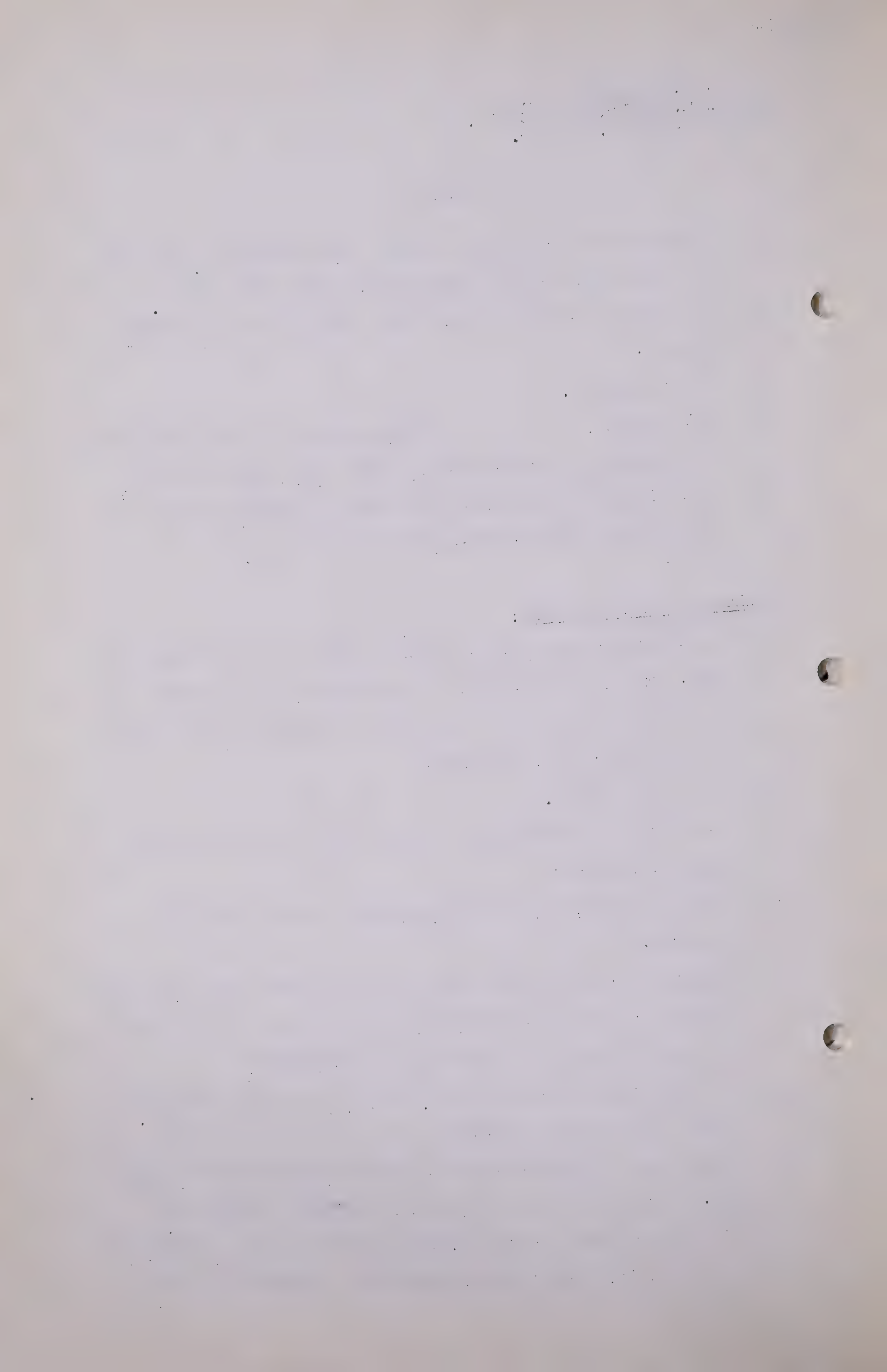
Q And that any load levelling required is done elsewhere than in Alberta?

A That is right, any load levelling is done outside of Alberta.

Q Would you care to elaborate at all on your suggestion that storage could be accomplished in the Turner Valley field for load levelling of Alberta's requirements?

A A preliminary study was made, as Dr. Dodge pointed out, and we had enough information to be convinced that a fault block in Turner Valley could be used to store this gas. There is an indication, as already pointed out, and I am repeating this because it is all the information I have on it, that it is certainly possible to put a







C. R. Hetherington,  
Exam. by Dr. Govier.

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cushion of sweet gas in a sour gas field and withdraw the sweet gas. Actual development of that plan, of the exact details of how to store gas, how many wells would be required, what exact structure would be picked, we believed fell within the range of operations of the Gas Company rather than ourselves. We do feel, however, that we have looked into it enough to know that it is certainly practical or a storage plan could be worked out.

Q I notice you used the expression "particularly suitable" in connection with the Montana storage field. Would you apply the same expression to Turner Valley?

A Well, I think the Turner Valley is even more particularly suitable because of its location.

Q What about the viewpoint of reservoir size and reservoir characteristics?

A Well, the reservoir is too large if a very economic storage plan is to be worked out. To take the whole reservoir I believe there is too much volume there. By certain pressure measurements that have been made it is indicated that certain of these fault blocks are isolated and the gas could be stored for smaller quantities without substantial leakage from one part of the reservoir to another.

Q Dr. Hetherington, is it your plan or the plan of your client to submit details concerning the practicability of storage in Turner Valley?

A No, it is not.

Q Thank you.



• • • • •



C. R. Hetherington,  
Cr. Ex. by Mr. Steer.

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CROSS-EXAMINED BY MR. STEER:

Q I wonder if I could ask one more question, Dr. Hetherington. Assuming that gas at Pincher Creek costs, we will say, "x" cents and that gas is to be transported to Turner Valley, stored and then taken out, how much would you add to the "x" cents for the additional carrying and storage charges?

A Well, that depends on the quantity of gas to be handled. The first year if you need this 2.6 billion cubic feet, or whatever it is that the Board has estimated for 1958, that gas would come rather expensive if the line from Pincher Creek were constructed for its ultimate capacity. On the other hand, that is closed gas that can be obtained and as that quantity of gas would increase it could be transported at a lower cost per Mcf.

Q Would you give us any figures at all?

A well, I can give you some figures from which we could work out an answer. This 18-inch line, we might just round it off in a round number and say that that line would cost \$2750.00 per inch mile or about \$50,000.00 a mile complete.

Q How far is it to Pincher Creek?

A Pipeline miles, I believe it is about 150 miles. It is about 135 miles pipeline distance, which would make a cost of somewhere in the neighbourhood of six or seven million dollars roughly for that pipeline.

Q Can you give us any approximate figures on carrying charges?

A They would depend on what return the gas Company made. They would run from 16 to 18 per cent total operation







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Cr. Ex. by Mr. Steer.

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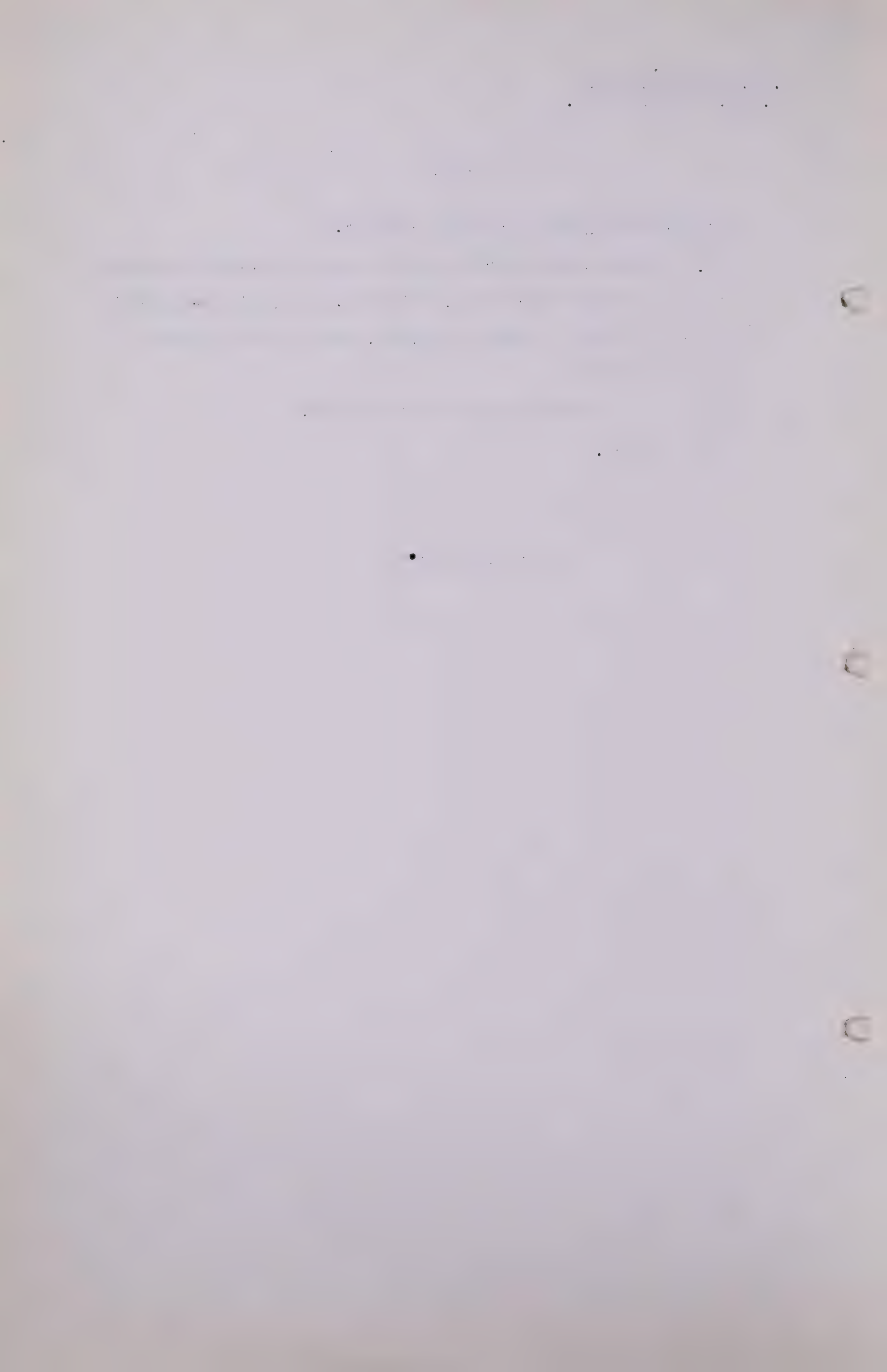
maintenance and all clearing charges.

Q Yes. Assume that we are going to carry, I think you mentioned a figure there of 2.6 billion, did you? Supposing you were going to carry 5 billion, what would the cost be in doing that?

A May I have a copy of the Board's report?

Q Here you are.

(Go to page 337.)





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Cr.Ex. by Mr. Porter.

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A Covering the range of the deficiency for it in 1958, according to the Board's deficiency for 1958, there was a deficiency of 3.6, and in 1979 a deficiency of 45.6. The 3.6 billion cubic feet would cost about 25 cents an Mcf, and the 45.6 million cubic feet would be about 2 cents an Mcf.

Q What was the answer with respect to 5 billion, Dr. Hetherington?

A That would be about 19 cents.

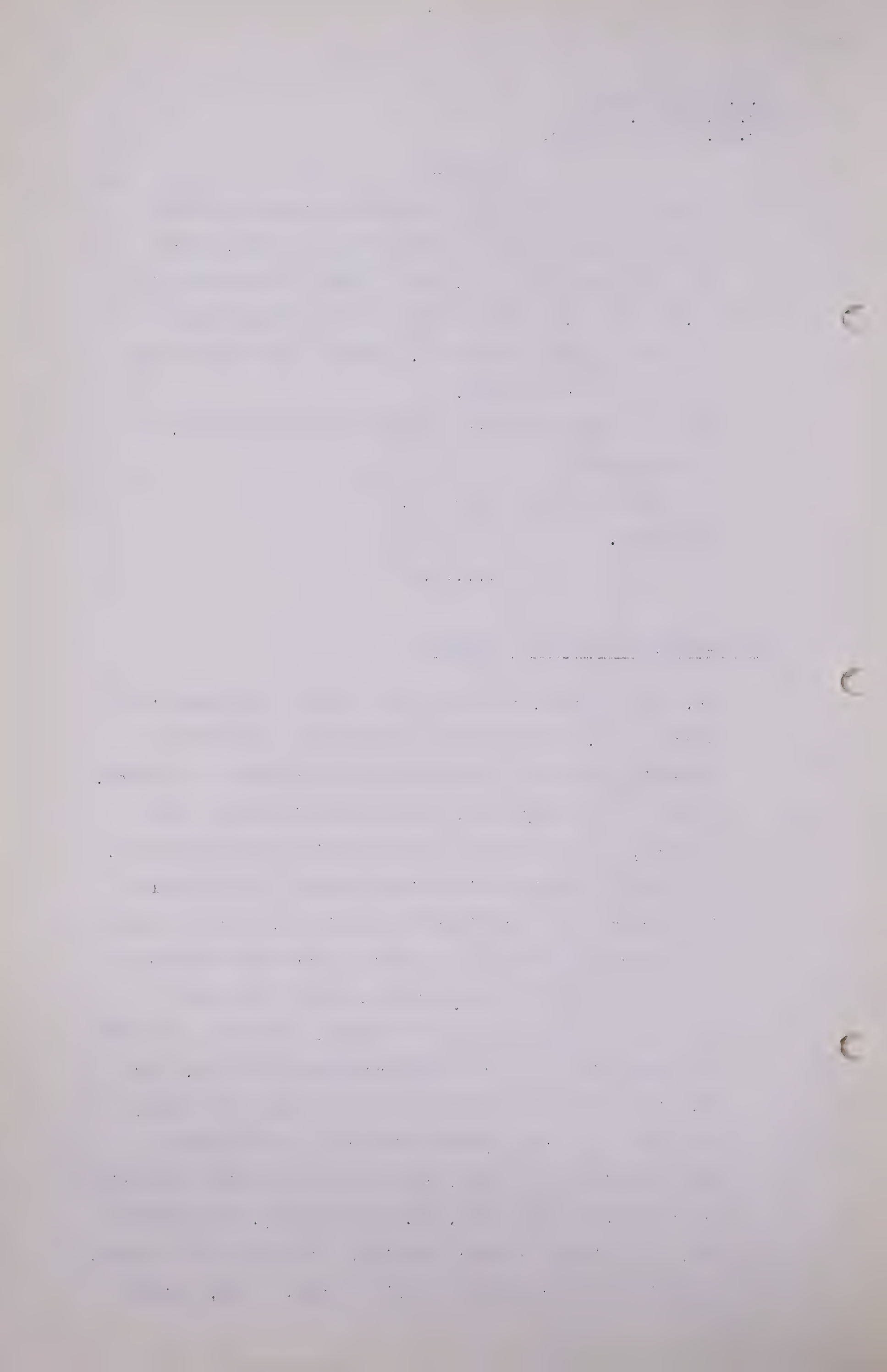
Q Thank you.

.....

CROSS-EXAMINATION BY MR. PORTER:

Q Dr. Hetherington, there are just one or two things that occur to me. At the moment, we have an exploratory operation going on 20 miles south of Calgary at DeWinton, we have the Bailey Olds, some 35 pipeline miles from Calgary, and we have the Shell drilling west of Airdrie, not over 30 pipeline miles from Calgary, all on geological prospects of considerable magnitude. Let us assume that over the period of the next 5 years those prospects, or others within a like distance, come in and make available a supply of gas to Calgary, after the structure has been built with its high transportation cost, what solution would you then offer the consumers of Calgary tied to a high cost system delivering gas 150 miles into the midst of plenty, cheap gas? I was just wondering about the practical side, Dr. Hetherington, the concept?

A Well, the timing in your question, I think, is the answer. You said in the next four or five years. Now, Calgary





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is not going to need any gas until six years, so that there will be plenty proved up, these new discoveries proved up before this line from Pincher Creek is actually constructed.

.....

CROSS-EXAMINATION BY MR. BREDIN:

Q Dr. Hetherington, barring new discoveries, and going into the question which Mr. Steer has asked you about the 1958 problem of the pipeline, there is bound to be an increase passed on by Canadian Western to the consumers of the city unless these new fields are found, is that not the case?

A Well, I would certainly say that if they have to go further for gas that the cost might be greater.

Q Yes?

A On the other hand, the present system of Canadian Western is of low-pressure pipe. They have what would today be a large expenditure for low capacity. Now, in the future, you would build high-pressure pipe of high strength steel, and the cost would be comparable as your carrying capacity would be greater. I would expect that these would give more than twice the present capacity of Canadian Western, so that it might even be expected that gas can be gathered cheaper than it is at present.

Q But, at any rate, this could not be done without some increase in the cost to the consumer, increase to the present costs?

A I do not know anything about that.

Q Would you hazard a suggestion that it could be done as





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Cr. Ex. by Mr. Bredin  
Cr. Ex. by Mr. Porter

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cheaply?

A Well, if you give me a little more details, be a little more specific and tell me where this gas would come from?

Q Well, I was thinking of your Pincher Creek 1958 problem as it is outlined on page 9 of your report?

A Yes.

Q It would be necessary to increase the price in order to make that feasible, would it not, to take care of the pipeline as is suggested?

A No, I am not sure that it would be necessary to increase the price of gas to do that, because that quantity of gas increased from, the Board points out, 3.6 billion a year to a substantial quantity during the first year of operation. Let us say the cost of getting the gas is certainly going to be greater in later years, but very shortly that gas or the cost of it gets down to a reasonable figure. As to whether that would affect the rate I am not prepared to say, because the rate is certainly based upon the depreciated value of the present system and that, combined with the new investment, may well lead to the same rate.

Q Thank you, Doctor.

.....

CROSS-EXAMINATION BY MR. PORTER:

Q As I understand your proposal that you have here, as it has been outlined, I understand that you propose to come along later with the details so that some estimate of costs can be more fairly made. You propose to gather some figures about the line, did I understand you to say





C. R. Hetherington,  
Cr. Ex. by Mr. Porter

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that?

A No.

Q I thought in the second phase of the case you said something about coming in with the details?

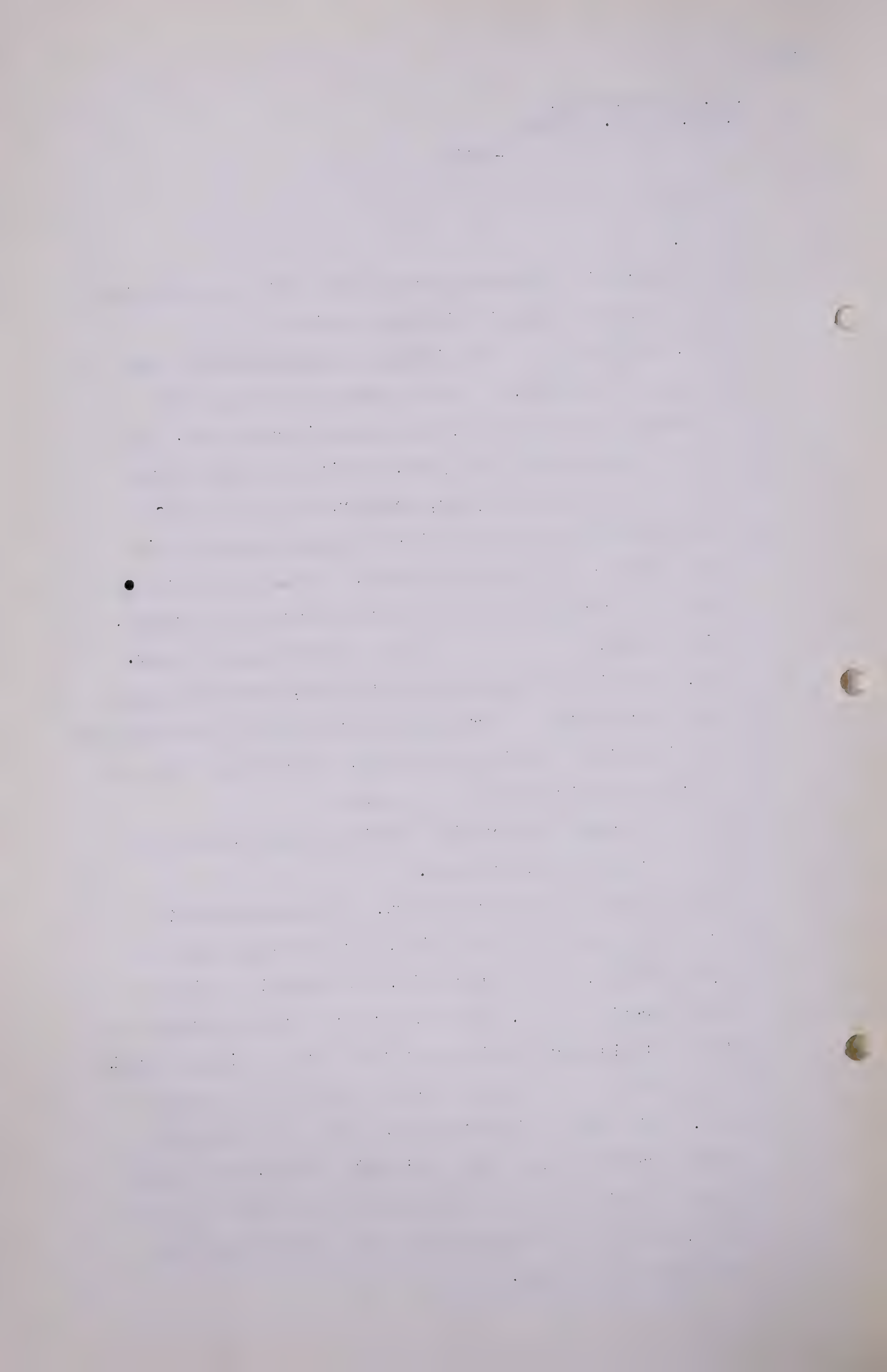
MR. McDONALD: We will give consideration to the examination today. I do not want to calculate the Canadian Western Natural Gas Company's rate base. We had completed that last year, and it took about three months to do it last year, however, we will give you a horseback figure which will determine whether it is economic or not in general terms. We certainly are not going to recalculate the rate base for the Gas Company.

MR. PORTER: I have not made myself clear. Dr. Hetherington was asked about costs, and I had understood earlier that he contemplated putting in more detailed studies of the physical operation, and I thought that at that time we might discuss the cost.

A In the second phase of this hearing I had reference to the cost of the export plan.

Q But not of the Canadian Western, the Canadian plan?

A No. With respect to this plan, and referring back to these Tables, as the Board did, the thing is entitled "Illustrative Plan", and it is based on the reserves that the geologists can estimate at this date. Pincher Creek is the closest gas and the closest gas is the cheapest gas. This plan is illustrative. And as you point out with regard to Bailey Olds and Shell McKidd, with regard to them coming in there will be gas closer which can be used, but right now we have dealt with figures and show how that can be done.





C. R. Hetherington,  
Cr. Ex. by Mr. Porter.  
Re. Ex. by Mr. McDonald.

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Q I only wanted to know if at some stage in this Hearing, this particular Hearing, we might hope to have a little more detailed study of the physical cost of doing the job on the basis of your assumption, so that we would be a little more intelligent in our consideration of costs. That is all I was asking, because frankly, Mr. Chairman, it is a little difficult to compare a practical established rate base with a plan evolved as far in the future and without more detail than is apparent just now.

MR. McDONALD: We will give consideration to the suggestion of Mr. Porter. There is just one thing that I have, if I might ask Dr. Hetherington with regard to it.

.....

RE-EXAMINATION BY MR. McDONALD:

Q You have made it clear in your submission, that there are two ways of doing this thing, and one is to do it piecemaal as the load increases?

A Yes.

Q By bringing one line from Pincher Creek to the vicinity of Macleod and then to the main line?

A Yes.

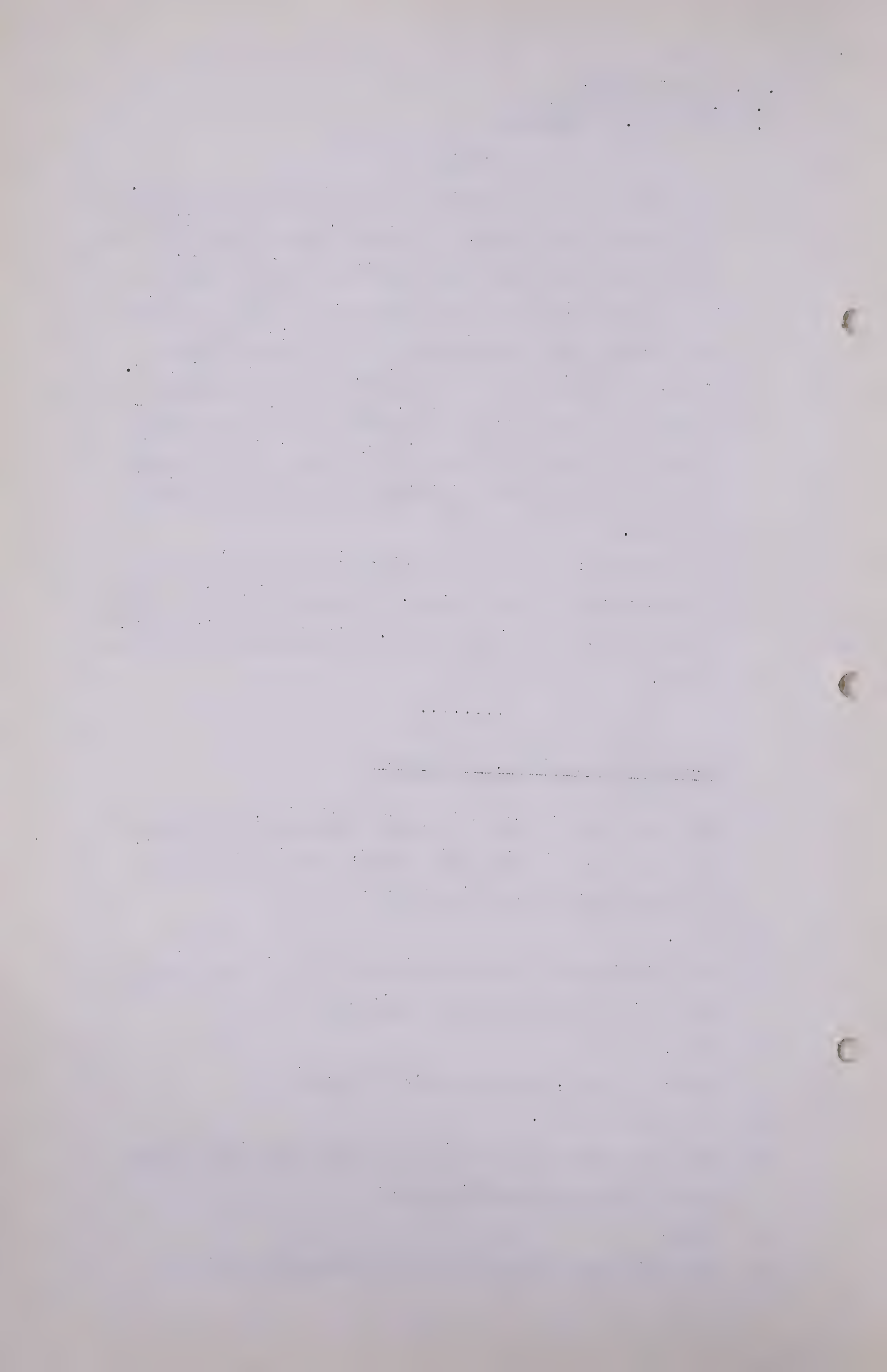
Q Which is what, approximately 45 miles?

A Yes, about that.

Q And the other was to build your main line from Pincher Creek direct to Turner Valley?

A Yes.

Q You also made it clear in your submission that the





C. R. Hetherington,  
Re.Ex. by Mr. McDonald

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capacity of the present lines from Turner Valley to the Canadian Western's system would take care of this additional load on a peak-day basis?

A That is correct, yes.

Q Yes?

A In that connection, Mr. McDonald, my answer to Mr. Steer's question as to the cost of delivery of the 3.6 billion was based on building the direct line from Pincher Creek to Calgary if the load were going to increase precisely as the Board has estimated, 3.6 billion, the first year, and then 7.5 billion the next year, and the most logical construction scheme then would possibly be the alternate 2 shown on the map in which the first year's construction would involve about 20 billion cubic feet, and the 3.6 billion cubic feet could be delivered for about 8 or 9 cents an MCF.

Q And as the load increases, that will be even lower?

A Yes, as the load increases that will be lower. And as the load increases also it would be necessary to loop part of the 16-inch pipe.

Q MR. STEER: You are talking about transportation costs solely?

A Yes, sir.

Q MR. PORTER: That is, we would have to add scrubbing and the purchase price to your 9 cents?

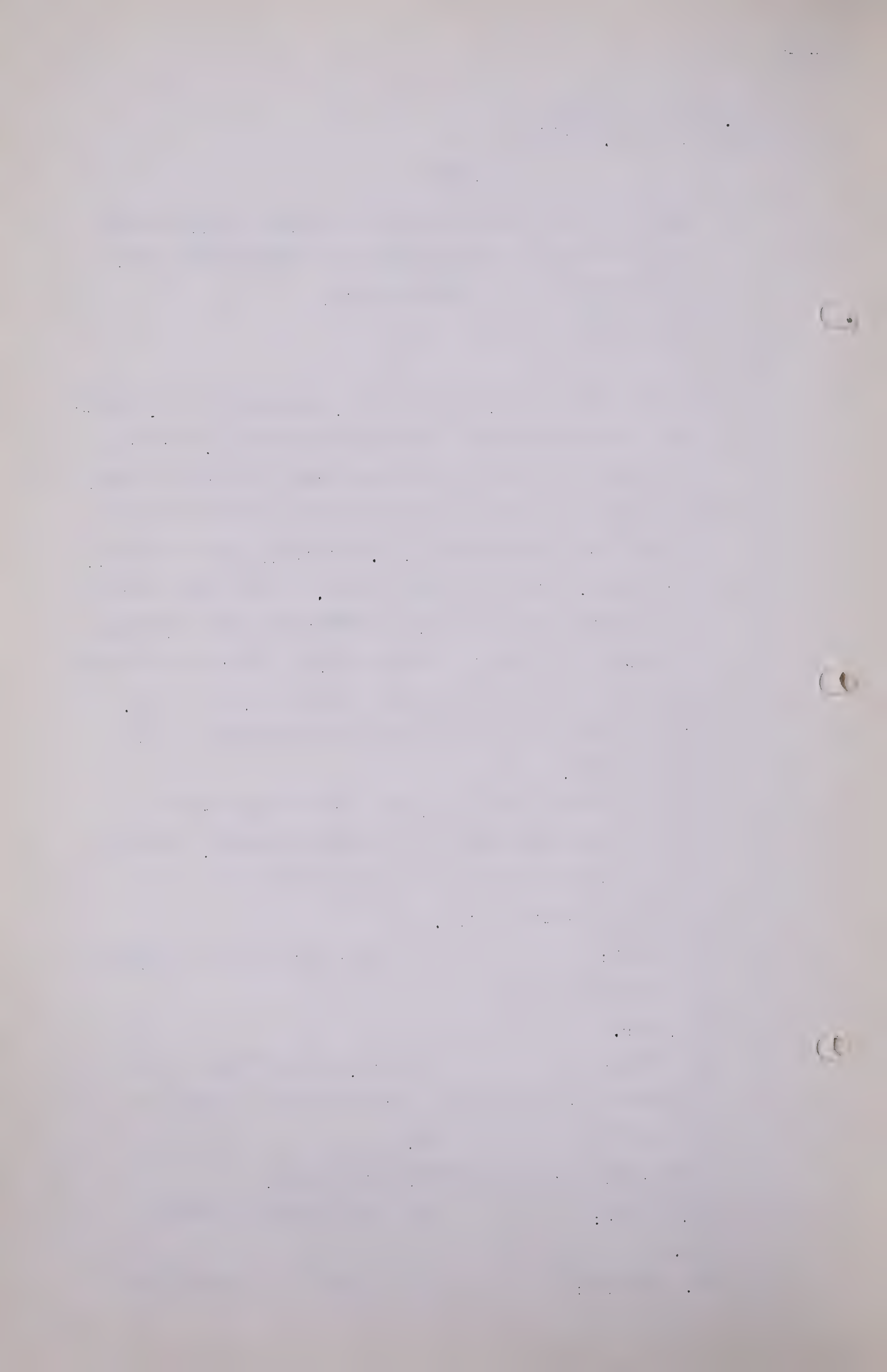
MR. McDONALD: No.

A I am talking about transportation costs.

Q MR. PORTER: Just transportation costs?

A Yes.

Q MR. McDONALD: But the gas as it comes from





C. R. Hetherington,  
Re. Ex. by Mr. McDonald

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Pincher Creek is going to be scrubbed and cleaned as it leaves Pincher Creek?

A Yes, sir.

Q The scrubbing would not be done on the Canadian Western system?

A That would be done earlier.

Q MR. PORTER: You would buy it scrubbed?

A Yes.

MR. McDONALD: There is one thing, sir, that was raised by Mr. Nolan, and possibly I should enlarge on it for the information of the Board as well as any other parties interested.

Q Mr. Nolan raised the point of 30 years' requirements for the Peace River project of the Westcoast Transmission Company. Now, is it necessary for 30 years of gas requirements to be available for the Westcoast line before the Westcoast line can be built from the Peace River to the Pacific Coast?

A The experience in the United States shows that many lines have been authorized by the Federal Power Commission and constructed with less than the amount of reserve required to cover their service line.

Q What experience have you in mind?

A A couple of examples to illustrate this trend of the Federal Power Commission in setting the requirements. The Tennessee Gas Transmission Corporation and the Texas Eastern Transmission Corporation - I want to make a correction there. It is the Texas Gas Transmission and the Tennessee Transmission, Docket G859 and 1089 and others, where construction was authorized with 100%





C. R. Hetherington,  
Re. Ex. by Mr. McDonald

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deliverability for 12 years, 73% for the following 3 years, 67% for the following 3 years, and 45% for the following 2 years. Texas Eastern had a total volume of gas in the ground of 94% for 20 years, with 100% deliverability for 8 years, declining to 59% in the 20th year. That indicates gas reserves of the order of 20 years with deliverability of 8 to 12 years, a recognized period.

Q Are those particular lines, or were those particular lines financed and in operation?

A Yes, they are.

Q Now, what is the initial requirement of the Westcoast Peace River line?

A The initial requirement of the Peace River line is 30 billion cubic feet a year. This amounts to 900 billion cubic feet for the service life of the pipeline, the depreciated life, 750 billion for 25 years, 600 billion for 20 years, and 450 billion for 15 years.

Q What about the third-year requirement?

A The third-year requirement is 50 billion cubic feet, and this amounts to 1500 billion cubic feet for the service life of the pipe, 1250 billion for 25 years, 1000 billion for 20 years, and 750 billion for 15 years.

Q Are you right in your first figure there, the 1500 billion cubic feet? That is for the third year?

A Yes.

Q Now, how about the fifth year?

A The fifth year requirement is 70 billion cubic feet a year.

Q What is the requirement in the 25th, the 20th, and the 15th year?

A 1750 billion cubic feet for 25 years, 1400 billion cubic



C. R. Hetherington,  
Re. Ex. by Mr. McDonald

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feet in 20 years, 1050 billion cubic feet in 15 years.

Q Now, Dr. Hetherington, is the matter of the availability of gas in the general area of supply for a pipeline, taken into account in determining the feasibility of pipelines in the United States?

A Yes, it is. The amount of gas deemed by the Federal Power Commission to be adequate as reflected from their knowledge of the area from which the gas is taken, Two references there are, Texas Gas Transmission Company, 3 FPC 442, and the Texas Eastern Transmission Corporation, and that is FPC 148, in which the Commission gave consideration to the availability of gas in the general area from which the pipelines originated.

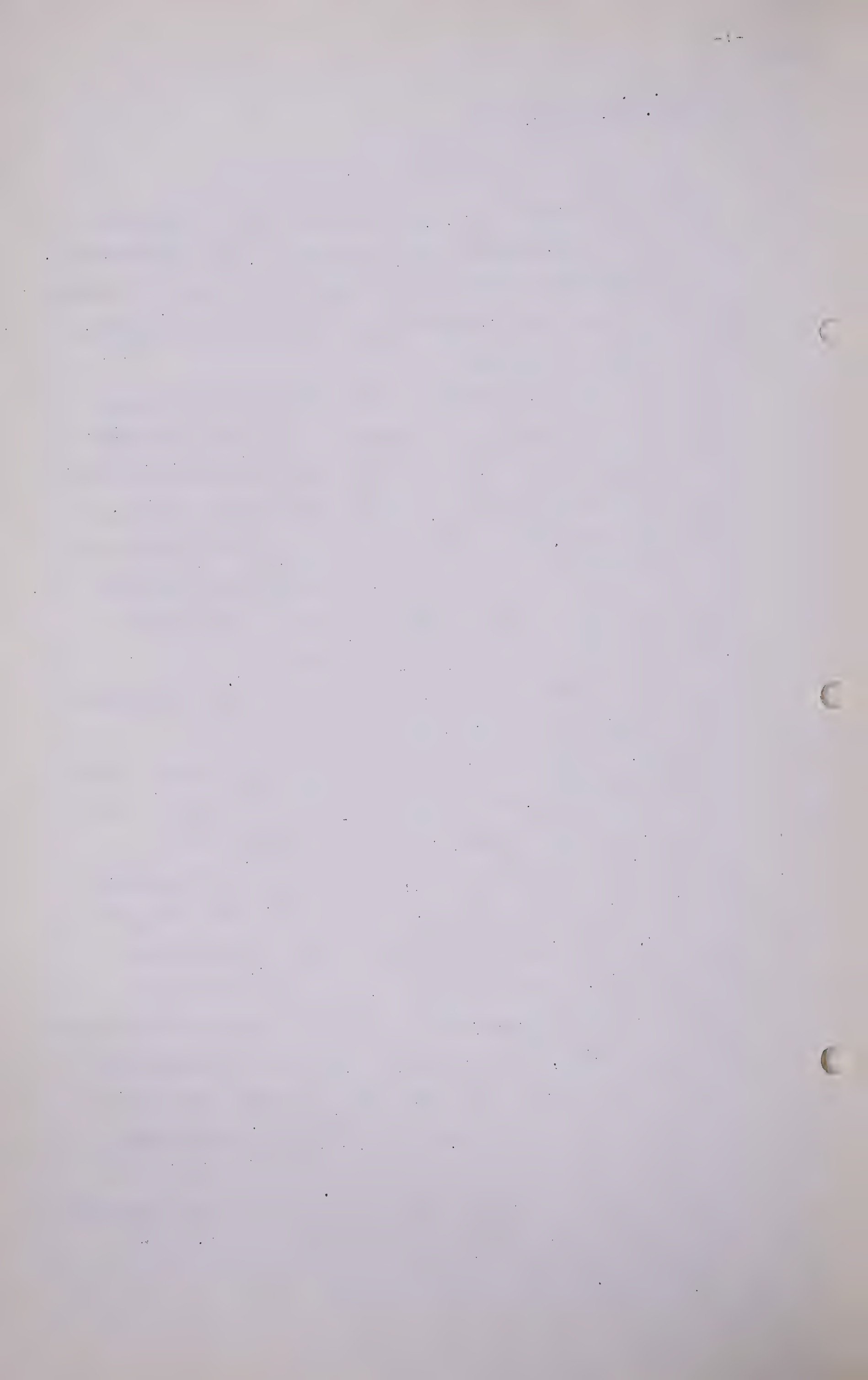
Q Does the Federal Power Commission deal with this matter of supply in the initial year?

A Yes. In several instances, particularly one with which I am familiar, is the Michigan-Wisconsin Pipeline Company in Docket G1156, in which the Federal Power Commission found that the pipeline company had deliverable gas for 15 years, totalling 75 billion cubic feet a year. The pipeline company was requesting more gas than this, but 75 billion cubic feet was the initial phase, and the capacity on which the Commission authorized them to build, the initial capacity of 75 billion cubic feet based on the then available reserves, and as the reserves were proved up, the certificate was granted for the original capacity requested.

Q And there the original application was for what, approximately 100 billion cubic feet a year?

A 110 billion.





C. R. Hetherington,  
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Q Yes? Now, in the exhibit with which you are now dealing, which is one with regard to the future requirements of the Canadian Gas Company, you have on Table No. 1, 20-year export requirements for gas, and you mention export in the year 1953?

A Yes.

Q And it goes up gradually, until the year 1960, is that right?

A Yes.

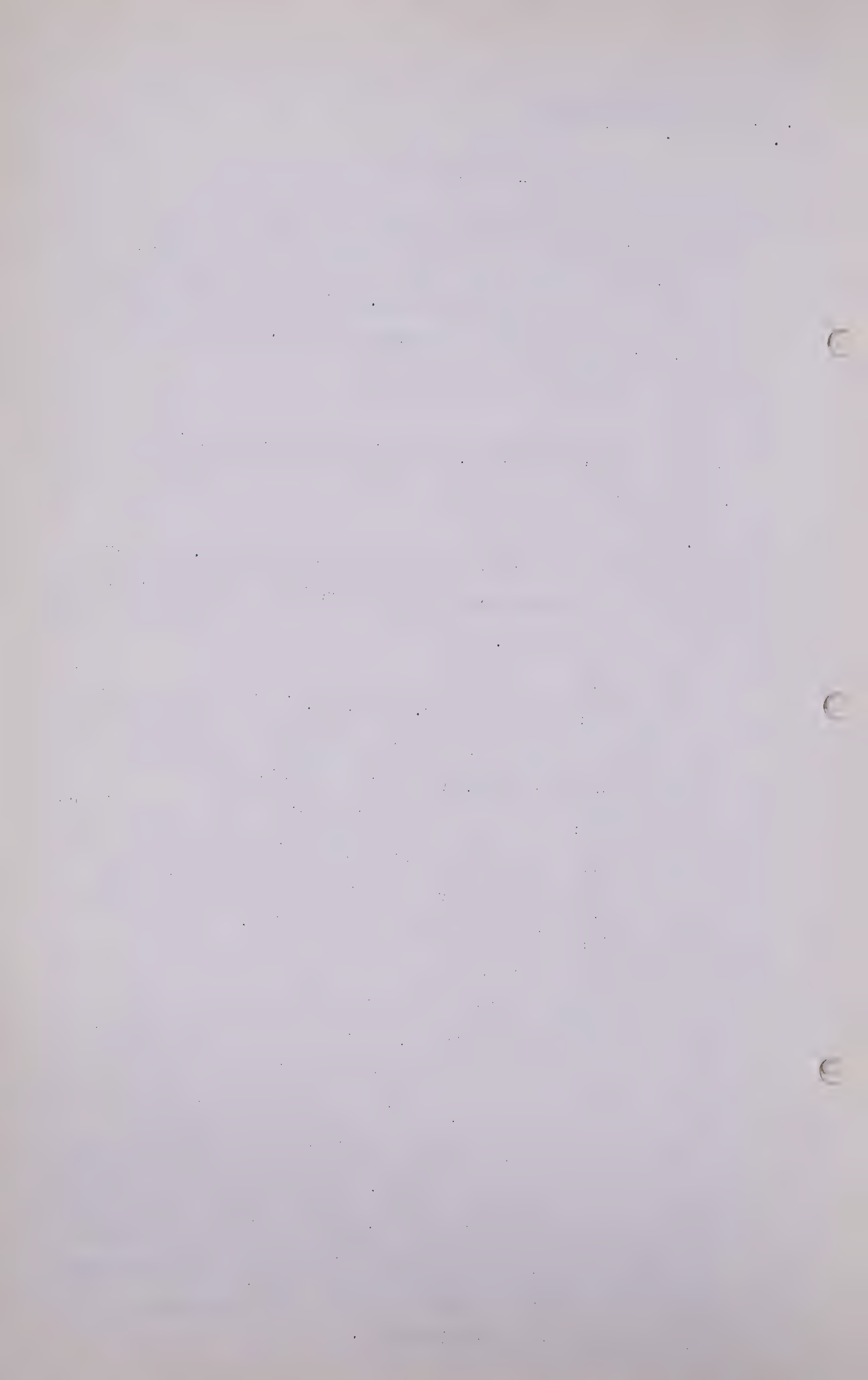
Q And that is the usual procedure that is followed, or follows on the commencement of the operation of these ventures?

A Yes, that is correct.

Q That is all.

THE CHAIRMAN: Mr. McDonald, is it your intention to lead any further evidence in reference to the Turner Valley storage project, as to its feasibility?

MR. McDONALD: I did give quite a bit of consideration and did some preliminary work on it, and have found that the time is too short to make up a presentation which would deal particularly with the economics. That will require some consideration of the ownership of the area in Turner Valley which is selected as being the reserve area. We take this position, that the Turner Valley field has been the subject of storage for going on now better than 5, almost 6 years, and it has been a successful storage operation. I am not as familiar with Turner Valley at the present time as I was, so that I do not know whether it is in and out year by year, or whether it has been held for some years, but I understand it has been quite successful, and to that extent at least we have a fair knowledge as to the problems that are involved.





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And that particular proposition is that our gas is being re-run through the absorption plant and the scrubbing plant and instead as a result of our investigation where gas is placed in large quantities for annual input and annual withdrawal it might not require scrubbing and running through the absorption plant. If that is the case the economics are considerably improved over the present status of Turner Valley. I would have to give consideration, however, to the amount of detail that would be necessary to satisfy the Board with regard to the feasibility of the project.

THE CHAIRMAN: I think it has been mentioned that using the whole field would not be economic. Have you given any thought to any given area that you feel might be suitable for storage purposes?

MR. McDONALD: Yes, our intention would be a limited amount of the field. It would be towards the North end, North of the central part of the field, anyway. There are at least two possible areas but we did not investigate to compare the two to determine the economics on a comparison. We can give further consideration to that and we can outline our understanding of what should be the area of the field which would be a large step forward in determining the economics.

THE CHAIRMAN: The Board would like to have any information you can give us that would assist us as to the area that might be used for storage purposes.

MR. McDONALD: Yes, thanks.

THE CHAIRMAN: Thank you, Dr. Hetherington.



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MR. NOLAN: A few moments ago I asked Dr. Hetherington about the delivery characteristics and he told me, if I understood him correctly, that was something about which the Board would be informed at another time. For my information, am I right in understanding that this phase, if I might call it that, was to deal with the reserves, deliverability and Provincial requirements. I ask this so that I might be guided in adducing my own evidence. Is it a fact that the Board expects to deal with that at another hearing?

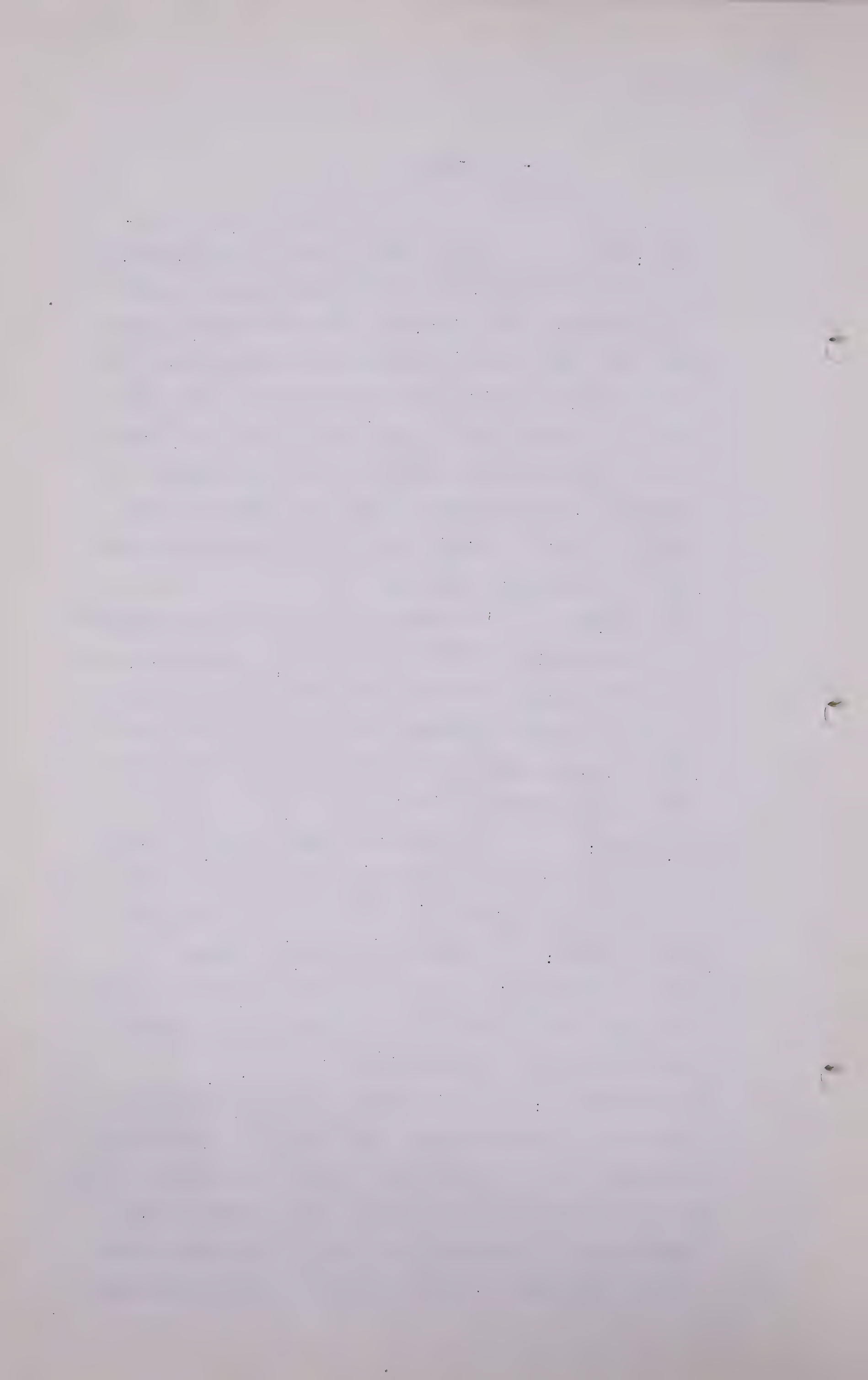
THE CHAIRMAN: I thought it was the understanding that the whole question of deliverability and reserves for both the Alberta market and the export market would be gone into. And we are certainly interested in seeing how the Alberta requirements were to be met and how the export requirements were to be met.

MR. NOLAN: So far as the deliverability of our local fields is concerned it would be proper, I think, to introduce that evidence in this the hearing.

THE CHAIRMAN: I think it would, Mr. Nolan. I think we would like to hear that evidence before a composite statement can be prepared. We would have to have all the evidence as to deliverability.

MR. McDONALD: If I may add something, there is on the record in the previous Joint Hearing a report covering deliverability. The Whitelaw field, for instance. There has been very little change up to the present and the development in the Tangent area and in the Hamlin Creek area or Dunvegan. Those fields have not been calculated





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and made available to the Board. They are in the process of being calculated now and before this hearing is concluded we would be filing a deliverability schedule with regard to the Peace River. Of course, Peace River is not one that affects the Alberta consumer. We thought on this particular question we were dealing only with the Alberta market, but that it would be of assistance to the Board in dealing with our own area in Peace River.

THE CHAIRMAN: Mr. Dougherty will be available now, Mr. Porter?

MR. PORTER: Yes, sir.

.....

JACK F. DOUGHERTY, recalled.

THE CHAIRMAN: Do you wish to examine Mr. Dougherty further before proceeding with the cross-examination?

MR. PORTER: No, I think, sir, I was through. Mr. Dougherty is now available for cross-examination.

CROSS-EXAMINATION BY MR. STEER:

Q You, of course, Mr. Dougherty, are familiar with the purpose of this inquiry?

A I think so, yes, sir.

Q Do you know that the Board has to determine whether or not there is a sufficient supply for Provincial requirements for a period of time and that also available for export elsewhere?

A That is correct.

Q And that time might be 30 years or it might be 50 years, although in the Board's report the 30-year period has been used?

1. The first part of the paper discusses the importance of the study of the history of the United States. It is a subject which has long attracted the attention of the people of this country. The study of our history is not only a matter of interest, but it is also a matter of necessity. We must know our own history if we are to understand the present and to prepare for the future.

2. The second part of the paper discusses the importance of the study of the history of the United States. It is a subject which has long attracted the attention of the people of this country. The study of our history is not only a matter of interest, but it is also a matter of necessity. We must know our own history if we are to understand the present and to prepare for the future.

3. The third part of the paper discusses the importance of the study of the history of the United States. It is a subject which has long attracted the attention of the people of this country. The study of our history is not only a matter of interest, but it is also a matter of necessity. We must know our own history if we are to understand the present and to prepare for the future.

4. The fourth part of the paper discusses the importance of the study of the history of the United States. It is a subject which has long attracted the attention of the people of this country. The study of our history is not only a matter of interest, but it is also a matter of necessity. We must know our own history if we are to understand the present and to prepare for the future.



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A That is my understanding.

Q You are familiar with that report?

A Yes.

Q In fact, I gather from your Exhibit 4 and 4A and this new Exhibit 10 that you used the report for some purposes?

A That is quite correct.

Q Did you use the report for the purpose of adopting any of its figures of reserves of gas?

A My recollection is that in the case of Jumping Pound we did take the Board's figures.

Q Is that the only case in which you use the Board's figures?

A I think that is the only significant one except in 4 and in 4A in some of the smaller fields in Census Division 13 I believe we utilized the Board's figures. I believe Mr. Trostel has re-estimated those fields and in Exhibit 10 the smaller fields like Elk Point and Elk Point Townsite have new estimates.

Q Your company was represented before the Joint Hearing, as I understand it?

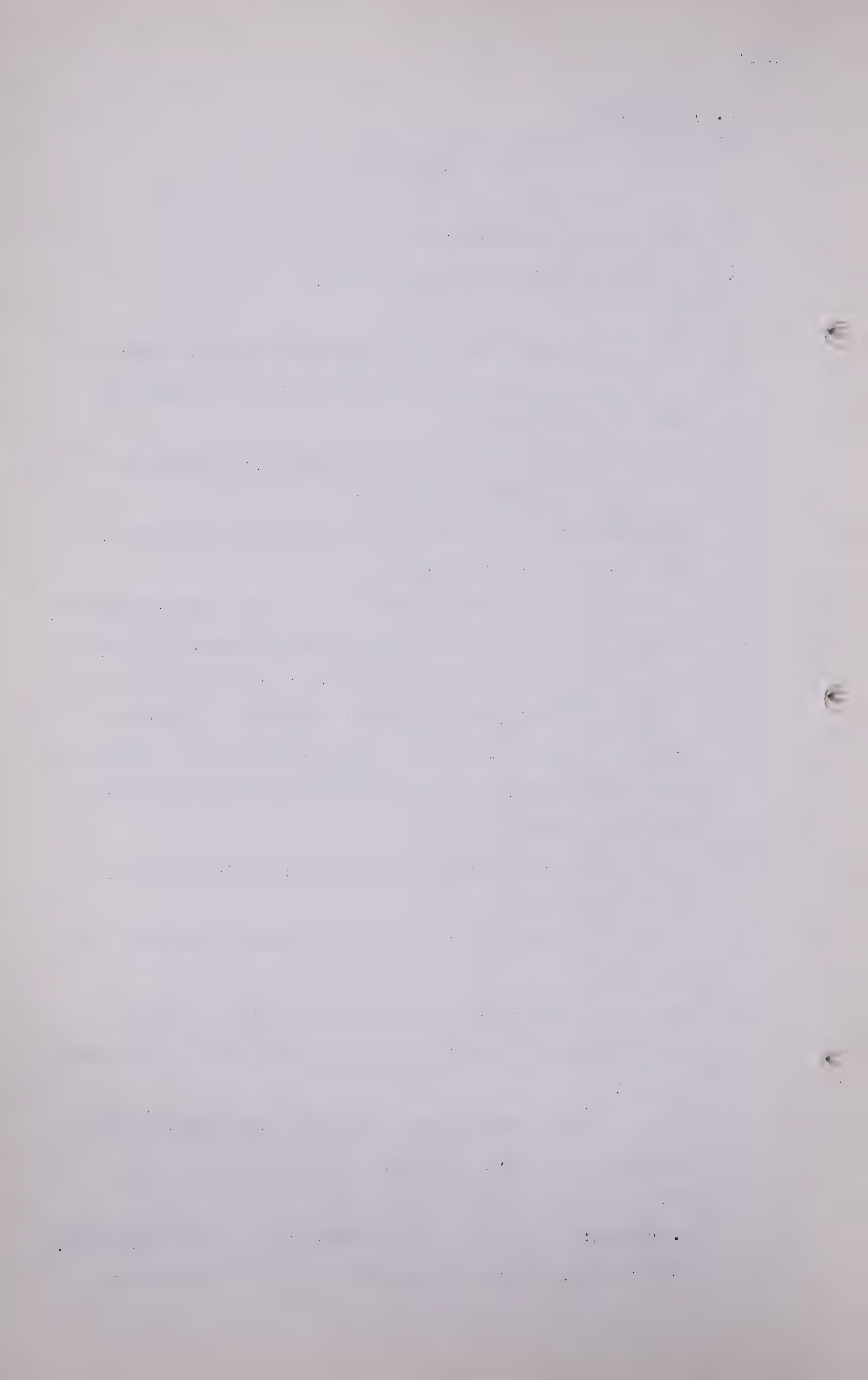
A I do not believe so, sir. I do not believe so but I am not sure.

Q When first did you come into this situation, I mean Canadian Delhi? Was it after the conclusion of the Joint Hearing?

A The date of our assignment, I believe, was approximately September 1st, 1950, roughly.

Q Yes?

MR. PORTER: The application of Canadian Delhi, Mr. Chairman, for the information of my friends, made its



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first appearance before this Board after this report in the May sittings in Edmonton.

Q MR. STEER: Then is it true that at the time of the Joint Hearing Canadian Delhi's application was before the Board, is that right?

A I assume so from what Mr. Porter has stated. I do not know of my own knowledge.

Q I suppose it is admitted by you, Mr. Dougherty, that if the Board's figure of 4658 billion cubic feet of available gas is the correct figure, then there is not any gas available in the Province of Alberta for export?

A If you make that assumption.

Q Yes, and the purpose of your exhibit is to induce the Board to change that figure and take your figure of total reserves of gas, some 8.4 trillion cubic feet?

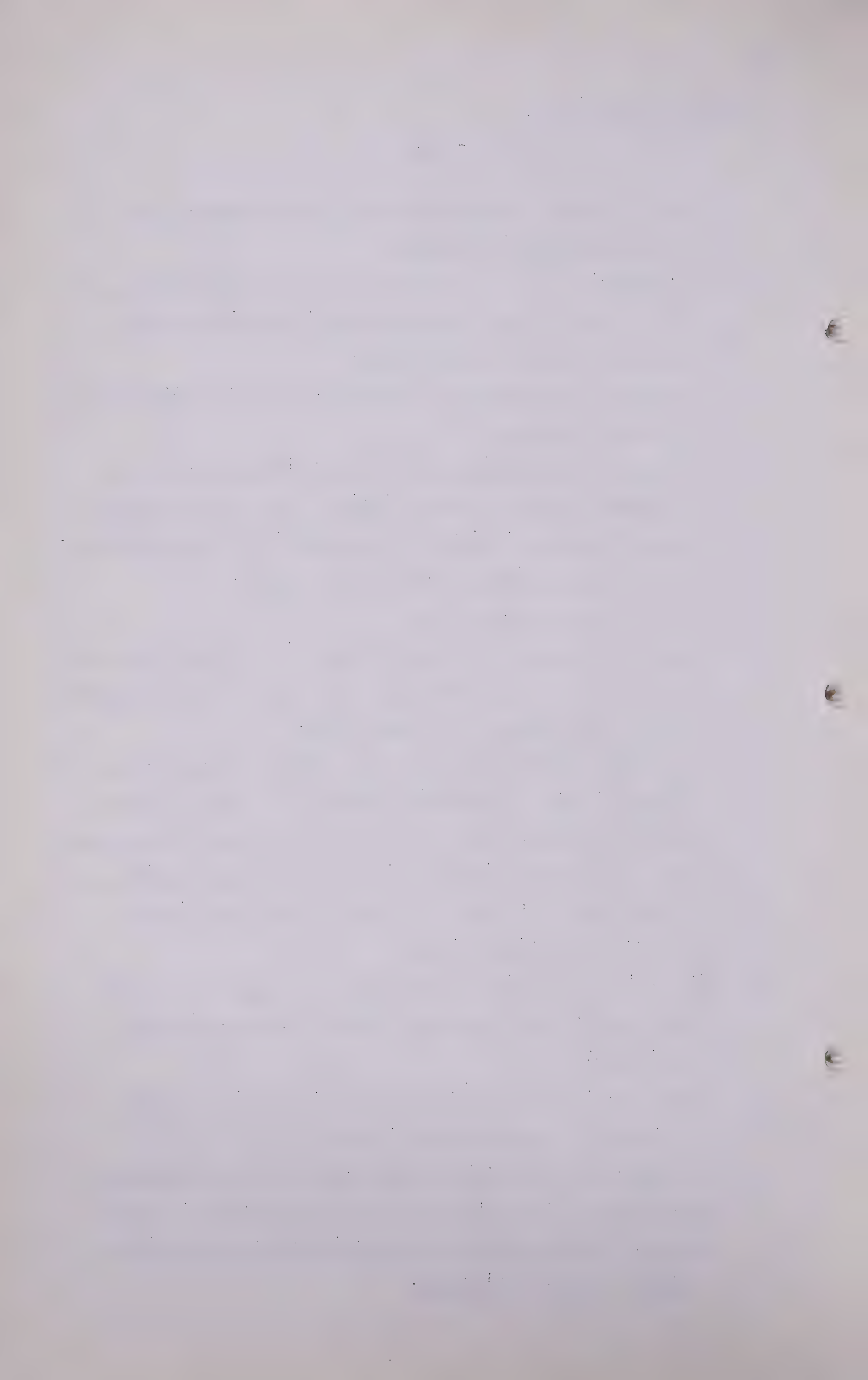
A That might be interpreted in that manner. However, our assignment from the Canadian Delhi was to make a reserve estimate of every field in the Province with no particular point of reserves directed either to any other estimate or to the Board, but purely an independent study without recourse to previous figures.

Q Well, it was not just that, because you had the Board's report before you when you started on your assignment, didn't you?

A Yes, sir, and we had every bit of data that we could accumulate in the entire province.

Q You knew that the figure on gas reserves in the Province would have to be increased very substantially over that used by the Board before your employers could possibly succeed in their objective?





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A Oh I think that is evident from the Board's recommendation.

Q It follows, does it not, that the Canadian Delhi application is virtually an appeal from the Board as to its findings of available gas based on additional evidence?

A In the result I do not know. We have made additional investigations and done additional work of which Exhibits 4, 4A and 10 represent the sum total.

Q What I am suggesting to you, Mr. Dougherty is that if that is the position, and I suggest that it is, that places a pretty heavy burden on the person who is going to tell the Board that it would be practical and that total quantities of gas for that does exist in the province.

MR. PORTER: I do not know how my friend can decently ask a witness here who is on a technical level to give technical evidence with respect to a study about some political or quasi political consequences. I do not want to object because his opinion is only worth what the background indicates but it does seem to me that my witness is being asked a question which the Board alone will have to consider the evidence on, the value of which surely will be apparent from the intensity and thoroughness of the effort.

MR. STEER: I would have gathered from Mr. Dougherty's appearance in the box up to this point that he requires very little protection and that he can very well look after himself.

MR. PORTER: I would like to get this clear, you are not suggesting I should go home, are you?





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- Q MR. STEER: Well, approaching this question, Mr. Dougherty, you would have to find evidence that more gas than the Board says was contained in the old oil fields that it examined and you would have to find evidence of gas in new fields. You have done both of those things in your report?
- A I would think that is evident, yes, sir.
- Q Yes. Now, am I right in this. You say that the Board should now find that the Province has 8.4 billion reserves as -- 8.4 trillion, I beg pardon, of reserves as of the 1st of August, 1951?
- A Yes, sir.
- Q And you regard this 8.4 trillion, do you, as pipe line gas?
- A That is correct, sir, under our definition.
- Q Now can you say how much of that, I might call it roughly 4 trillion over the Board's estimate of 4656, how much of that comes from the fields that the Board actually dealt with in its report and how much of it comes from new fields? Would you be able to tell us that?
- A No, sir, I have never made a study of that.
- Q Yes, and I suppose you are aware that the Board has found that for local consumption, to ensure it over 30 years, there must be connected to the Northwestern system and to the Canadian Western system each some 1100 to 1300 billion additional cubic feet. You know that?
- A I believe that is the general substance of the Board's report.
- Q Yes, and you are aware that one of the great difficulties of the Board is to ensure that those large quantities of



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gas, over 2 trillion cubic feet, should be available to those two systems if export is to be permitted?

A I think that is essentially correct.

Q Yes, and you think, I suppose, that your report has solved the Board's difficulties?

A No, sir.

Q No?

A The Board's difficulties transcend this report, I am quite sure.

Q Yes, and with regard to my 2 trillion cubic feet the difficulties still transcend your report, do they?

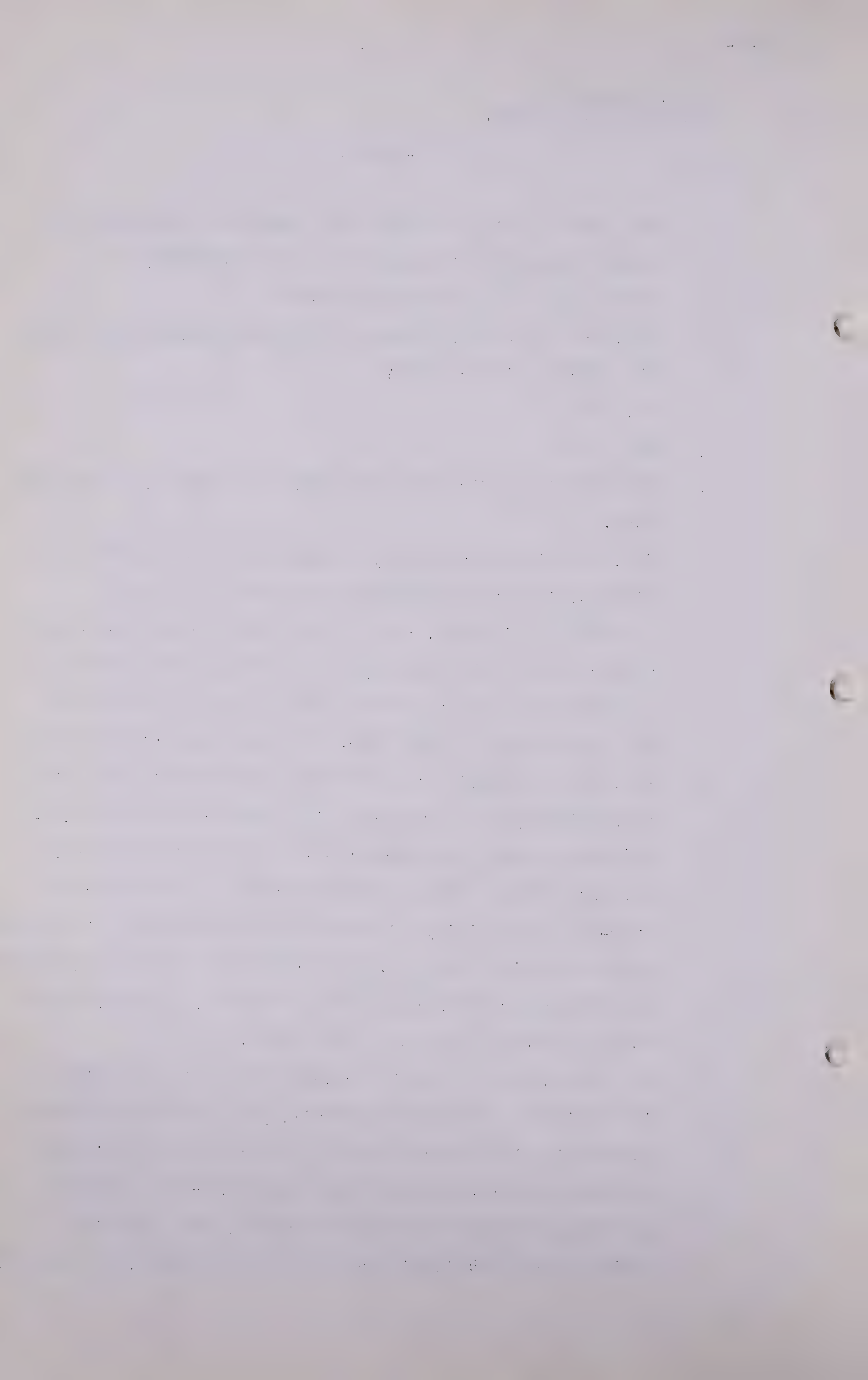
A I think that is true, but so far as the actual mechanical application of the delivery of that gas to the systems, I rather say that it is a function of the g s companies and not so much of the Board. That is a practical matter.

Q Yes, but you realize the fact that the Board is not going to permit export of gas until it is assured of the availability to these gas companies of this 2 trillion feet?

A I think that is true. I would qualify it by saying the over-all availability of reserves to the Province, including the 2 utilities, the actual distribution of that is a matter of practical operation and not a function, I think, of the Board possibly in the operating sense.

Q In other words, to put it broadly, and I will be going into this in a little more detail, you say that if Trans-Canada Pipe Lines take the gas closest to the utilities' systems and leaves the gas that is further out, smaller in volume and more difficult to gather, that that is a problem for the Utilities and not for the Board, is that it?





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A I think the over-all problem of final segregation of reserves is something which is going to be the cause of talks between the exporting companies and the Board and the local utilities, involving the economics of the situation for a period of 30 years. At this time I cannot predict how that is going to be done. I doubt if anybody could.

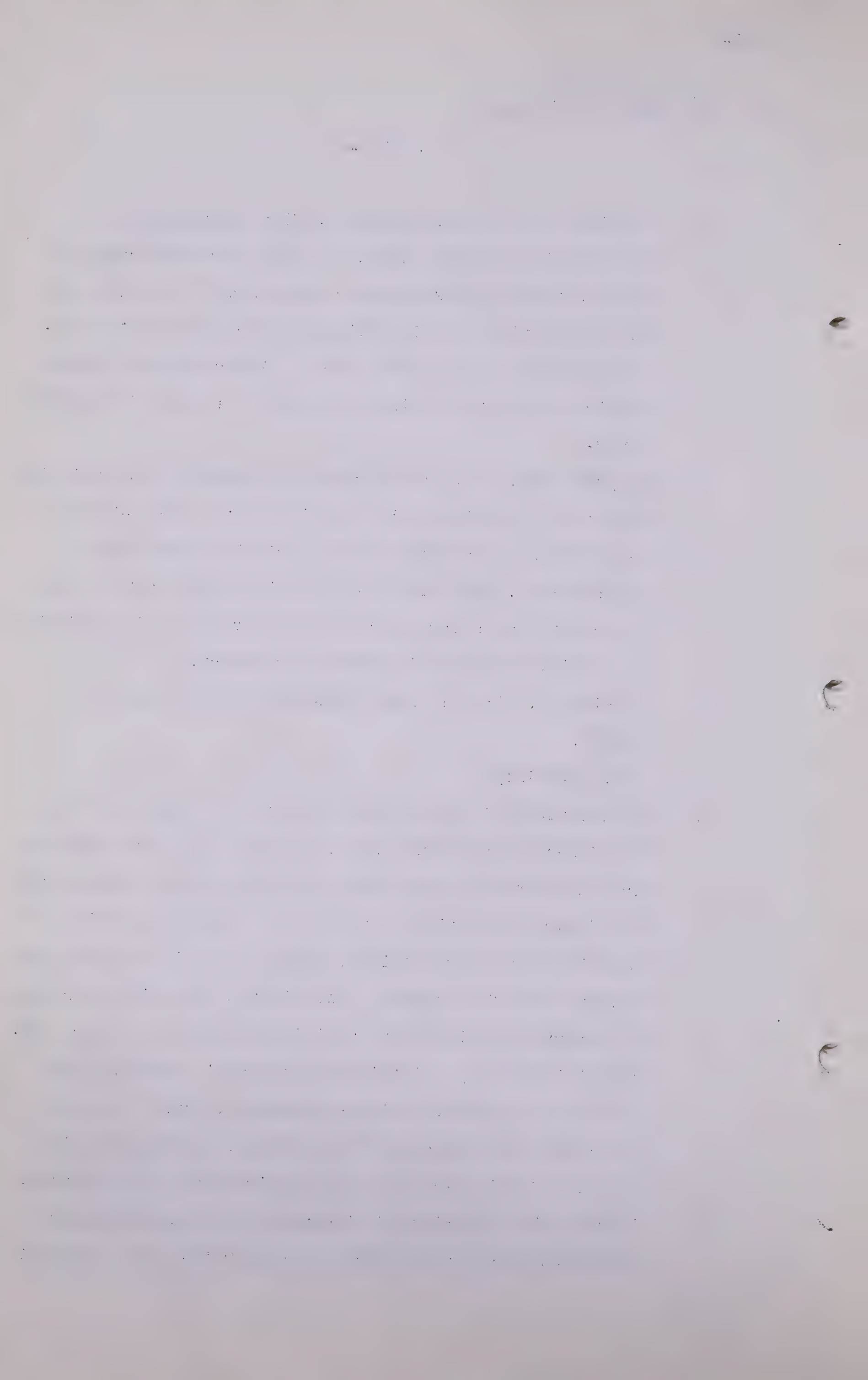
Q In your view, if your reserves be accepted at 8.4 trillion and if the quantity to be supplied to the Trans-Canada is 4.4 trillion then that leaves 4 trillion cubic feet in the Province, regardless of where it is and that if that is accepted as being the proven reserves that is sufficient to justify the Board in permitting export?

A I think so, sir. If I may elaborate it for just one moment?

Q Yes, certainly.

A We are rather in an anomalous position in that the Board has forecast the demand for 40 years or 30 years while we are in essence dealing with reserves as of this date, with no future projection of reserves. I cannot conceive of the discovery of gas being a static situation and that we now have our full supply. Within the next five year period or tomorrow we might have additional reserves in very substantial quantity. I think the company's problem is to show that presently indicated reserves, plus a trend in the whole development of the Province, is going to yield reserves far in excess of the requirements in the future.

Q In your view the risk of discovery of the additional gas should be borne by the Province rather than the exporter?





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A I think it will be borne by both and that the exporter will contribute very heavily in that development. In fact, the exploration for export would be the only reason where the Province could benefit in the long run.

Q Yes, but on your submission here, in your exhibit what you have taken for the exporter is the proven gas and then you say, as I understand you, that the risk of the remaining gas being found in the Province should be run by the Province?

A Oh no, it would be a joint responsibility and joint effort.

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Q But how could it be when you have on your statement satisfied the demands of your export company from what you call substantially proven reserves?

A I think that goes back again to the fact that we are looking at a certain time now, projecting the requirements for 30 years. I would say in the next 30 years the part of the reserves herein set out for a statistical purpose might well wind up connected to every one of the utilities and the adjustment between the provisions of the export lines would be on a practical economic daily oil and gas operating schedule. Those are statistical figures, they are not operational. The operational is going to take precedent after you get the respective systems going, they will be inter-related in the total gas economy of the Province.

Q The Board, however, is charged with the present duty of ensuring to the citizens of this Province an adequate supply of gas, we will say, over a period of 30 years. Now, I ask you, under those circumstances, whether risks which are inevitably involved should be borne by the exporter or should they be borne by the citizens?

A Well, I think the risks are in a common pool, that we can not segregate them. I personally have no qualms about the risk for either party in the Province of Alberta.

Q Yes. Well now, do I understand your plan to be that you have outlined in these Exhibits of yours certain fields of gas from which Trans-Canada Pipeline ought to be permitted to take gas for export?

A Proposes to take gas, and I think as time progresses





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those would be subject to change as additional developments take place so that the entire economic picture is going to be in balance between the exporter and the Province.

Q So the Board can not look on the figures as a definite scheme at all?

A No, sir.

Q They have got to say, This is a proposal and it may alter all the supplies for the Province, maybe got from some of those sources or they may be got from other sources?

A I think that is true because any study at this stage in fact of what may transpire over the next 30 years is only an index and should only be used as an index, not a final plan or system of operation. That is impossible at this time or any time.

Q But isn't it your responsibility to place before this Board at this moment a scheme which will permit your employer to export and at the same time ensure Provincial requirements over a period of 30 years? Isn't that your duty?

A I do not know about schemes. I do not like the terminology "scheme".

Q Plan?

A Plan is perhaps just as hazy.

Q Well, you give us a better word.

MR. PORTER: Now, where does this type of examination get us? If my learned friend wants to ask me about my client's duty, I could tell him what my





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opinion is and what my advice has been. The testimony that this witness is qualified to give and that he came here to give is given as physical reserves based on a physical examination of the known evidence. Now, Mr. Schultz has been on the stand and probably will be in again. Surely those questions of policy are questions for someone else other than a professional man dealing with a technical question.

THE CHAIRMAN: Mr. Porter, Mr. Dougherty has undertaken to differentiate between the Provincial reserves and what are going to be available for Trans-Canada, according to this Exhibit, summarized in Provincial reserves and what are available for Trans-Canada.

MR. PORTER: I have no difficulty with that at all, but I do suggest that to ask this witness what my client's duty is under this Act is rather to put him in a position where he is giving an answer which he is in no way qualified to give, and ought not to be asked.

Q MR. STEER: When was your firm employed, Mr. Dougherty, with regard to this work?

A My recollection is in September of 1950.

Q I wonder if I ought to drop the questions that you did not answer. I understood from my perusal of these documents of yours, Mr. Dougherty, that what you were doing was attempting to show the Board that it had in this Province enough gas to permit Trans-Canada to export 4.4 trillion cubic feet and ensure sufficient reserves for the use of the Province. Now, is that the purpose or not?



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A We think that is obtained from the exhibits.

Q Yes. Well, that is what I thought, Mr. Dougherty, and if the Board should come to a conclusion on your exhibits that you did not demonstrate sufficient supplies for the Province for 30 years from this time, then the Board requires more evidence before it can permit export, is that right?

A I do not think that sentence was finished. I did not quite follow what would happen. May we have that read back?

Q Yes, perhaps that is the best way.

BY THE REPORTER (reading): "Q. Yes. Well, that is what I thought, Mr. Dougherty, and if the Board should come to a conclusion on your exhibits that you did not demonstrate sufficient supplies for the Province for 30 years from this time, then the Board requires more evidence before it can permit export, is that right?"

A Oh, I would think so, yes, sir.

Q And you were employed in September of 1950, I believe?

A That is correct.

Q Yes, and your firm - by the way, how long have you been associated with it?

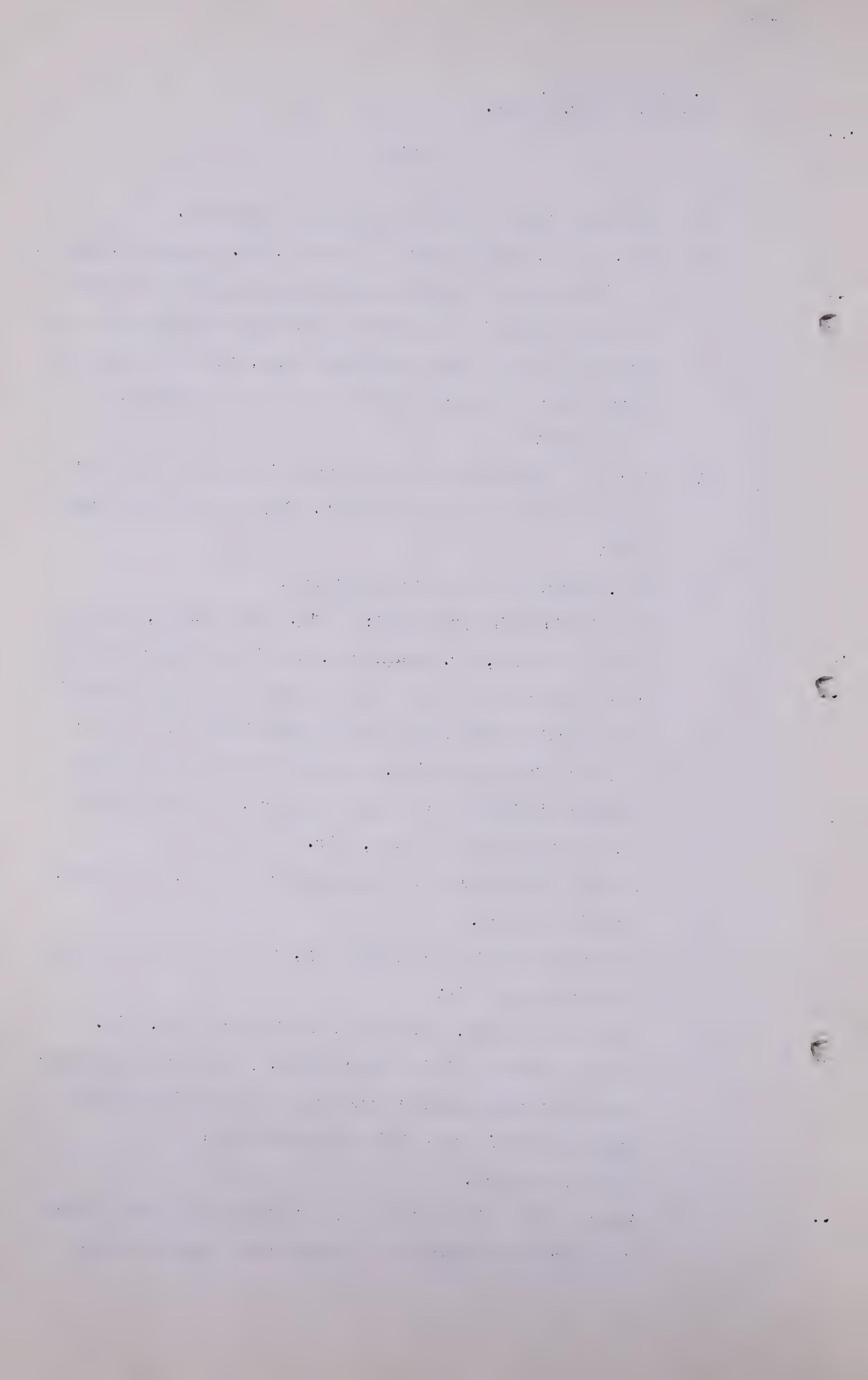
A About five years, five and a half years, yes, sir.

Q In the course of this association, your firm has undertaken advising numerous banking houses with regard to similar questions to this involved here?

A That is correct.

Q And are we to take it that your approach to this study was exactly the same as it would have been had your





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employer been a banking house that was going to advance money?

A I can not say the approach would be the same but I would have no hesitancy in submitting those exhibits and answers to a banking house or insurance company for the purpose of financing.

Q What would be the difference in the approach?

A It would probably be a good deal briefer.

Q You mean, bankers require less evidence, than ordinary folk, eh?

A No, I would not say that. I would say they would have a greater tendency to bog down in the detail.

Q So you would not give them the detail?

A I think they would be in the position of taking the opinion of DeGolyer and MacNaughton and taking their opinion from our files and working papers as they have done in the past.

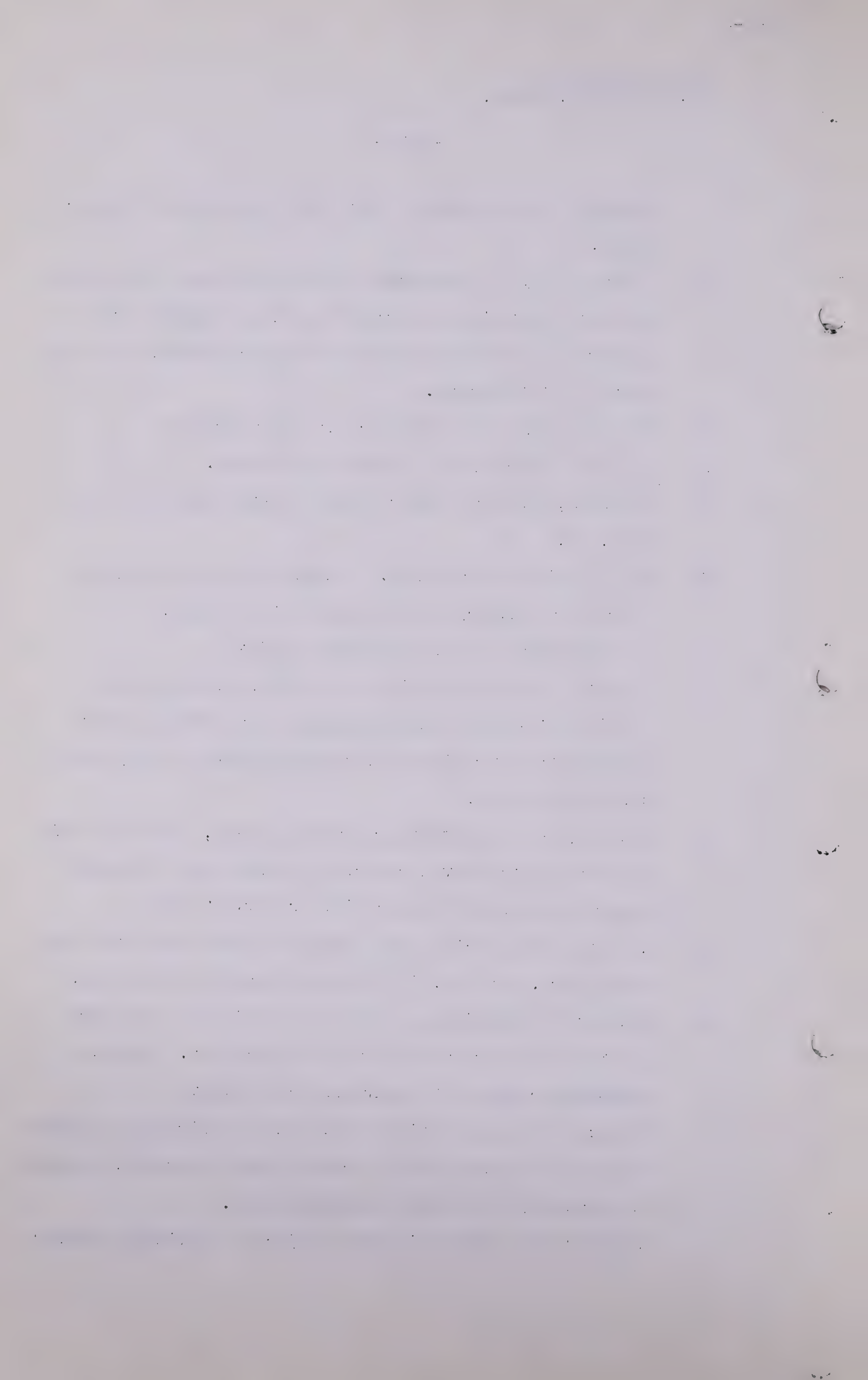
Q And if you were advising a banking group, would you tell them what your proven reserves and what your probable reserves and what your possible reserves were?

A We would use exactly these categories and the totals as shown here, that is, if I had anything to do with it.

Q No, but I am asking you about the policy of your firm so far as you are able to tell me about it. Is your knowledge confined to your own activities?

A I think that would still hold, that the firm would submit this type of data with the definitions of proved, possible and probably as we have submitted here.

Q And what you told me is that subject to giving a briefer





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report you would examine this situation and give the same figures to a banking group as you have given us here?

A That is true.

Q It follows then that you agree that the Board is entitled to the best judgment that you can bring to this question?

A Yes, sir.

Q And that involves that you obtain all the data that is available in this Province to form that judgment?

A Within the limits of our policy, yes, sir.

Q And did you, do you think?

A We made a very comprehensive piece of work in attempting to accumulate that data. It is not 100 per cent perfect.

Q Have you discovered any respect in which it is perfect?

A I know of nothing that is perfect, so I assume there are many imperfections here.

Q Tell me, you have given evidence, or at least, your exhibit is with a large number of wells and gives sand thicknesses, connate water, porosity figures. Did you with respect to all of those wells have the available electrologs and core analyses?

A In as far as we were able to get them. I suspect we have about \$10,000.00 worth of electrologs. We have every electrolog released through the electrolog service and I believe every electrolog which the company would release which have not been currently released through the electrolog service.

Q Then you place your estimates in three categories, I notice, proven, probable and possible?

A Yes, sir.



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Q And I think it is a division of those estimates that has created considerable difficulty in the minds of some of us. Your proven reserves you seem to define as being arrived at, and tell me whether this is right or not, by reasonable interpretation of available data?

A That is not quite correct.

Q Reasonable geological interpretation of structure, known continuity of oil or gas saturated reservoir materials above limiting water saturation. Now, I take it, in estimating those proven reserves those things are known to you, known continuity of oil or gas saturated reservoir material above a known limiting water saturation?

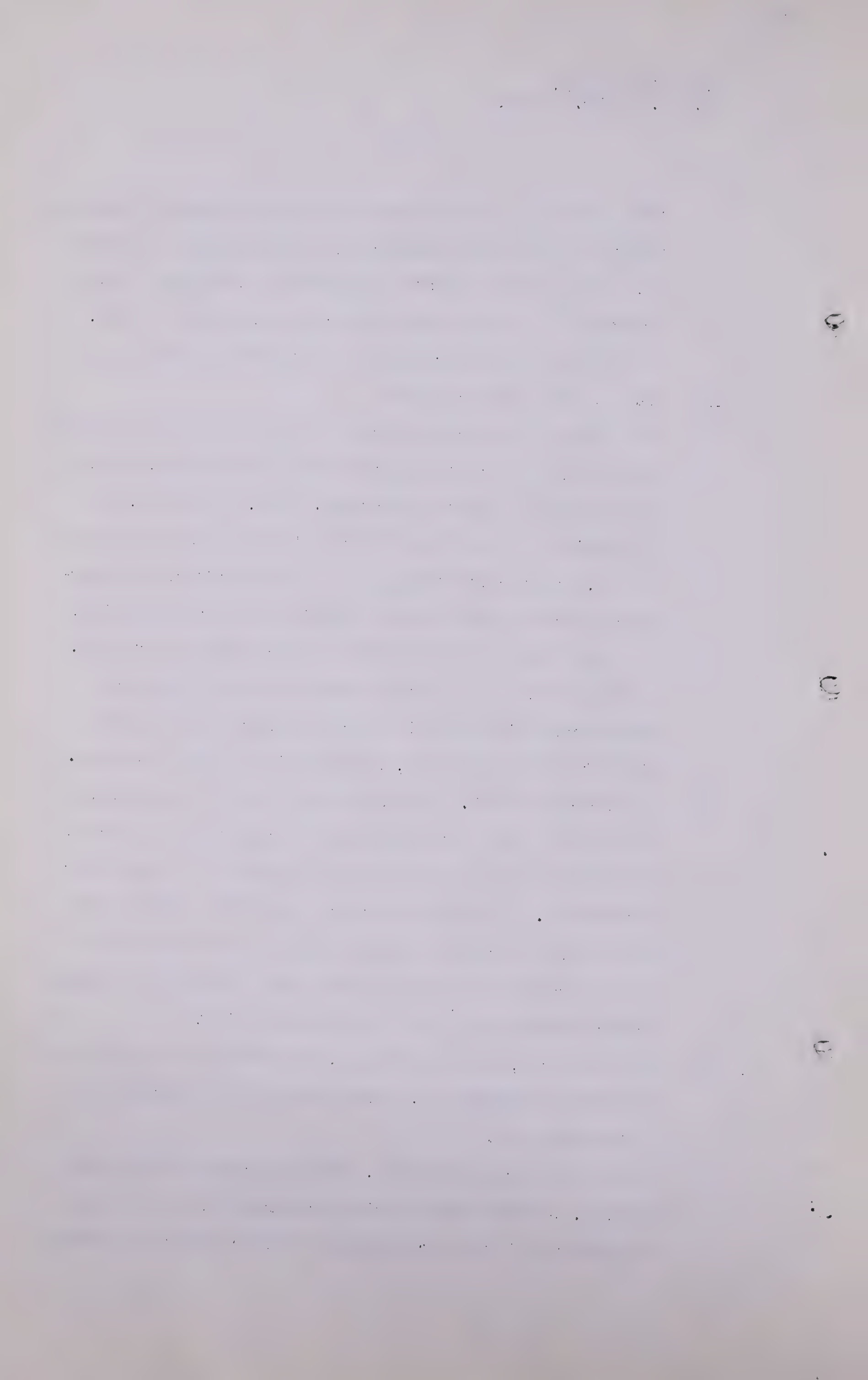
A I think that is breaking the sentence down too finely. I think in all those things there applies reasonable geological interpretation because there are no fixed absolutes even in water, water table or what have you.

Q I appreciate that. Then when you come to possible, I would like you to tell me what is meant in the second last line where you talk about inferred or known water saturation. I would gather from your last answer that it is only a greater or lesser degree of probability that is referred to there that leads you to say inferred water saturation in the second definition?

A That is true, but I think we are getting into kind of a dialectical discourse. Everything has its shades of interpretation.

Q Won't you agree with this, when you come to talk about proved, probable and possible reserves of gas you are talking about three categories in which there is strong





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evidence at the top, less strong evidence in the middle and very weak evidence at the bottom?

A Not necessarily. That is too simple. It is far more complex than that. I would like to give an illustration. If you will recollect the discussion I presented on Golden Spike in the Lower Cretaceous.

Q I remember, if you do not mind my saying so, your moving gas reserves up from possible to probable, but you did not put them into proven.

A Yes, sir, we put them into proven.

Q You have, eh?

A Because of those complex classification set-ups and the complex knowledge, we attempted to set off our judgment bases such as we had a very reasonable expectation of what we call possible would in time or with a little more control be proved, and we would rest our judgment upon the examples which we cited at some length.

Q By "a little more control", what do you mean?

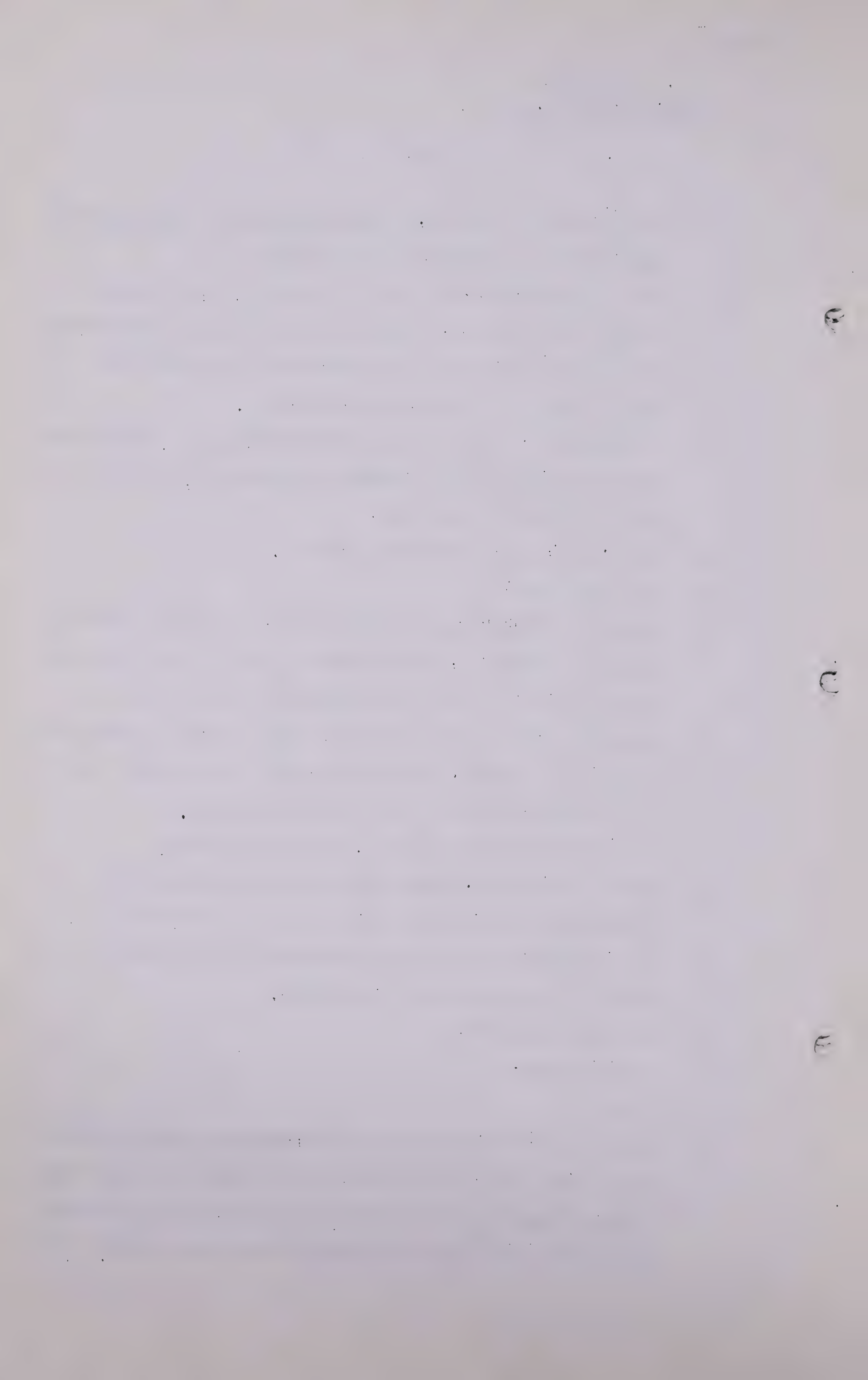
A Additional wells, additional drill stem tests. In Golden Spike before any drill stem tests were taken we by correlation inferred a water table in the Lower Blairmore in the electrologs from Leduc.

Q Now talking about?

A Golden Spike.

Q Yes?

A And found that when the Anglo-Calmont well was drilled that such water table proved, on the basis of drill stem, what we knew probably existed as a reserve but we could not prove it to our full desire, then became proven. We





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wish to have in effect our work treated as if with more control and additional data the possible areas, the probable areas and proved areas become co-extensive, so we have the reservoir assumed.

Q I think that is just exactly what I put to you a moment ago. You have got a proved area where you have got satisfactory information ?

A Well, I say all the information we can get. It is not very satisfactory.

Q It has got to be satisfactory to you before you venture to say that you have got a proved reserve there?

A That is correct.

Q So you have a proved area in which you got satisfactory information?

A We consider satisfactory to the extent that we can get the information.

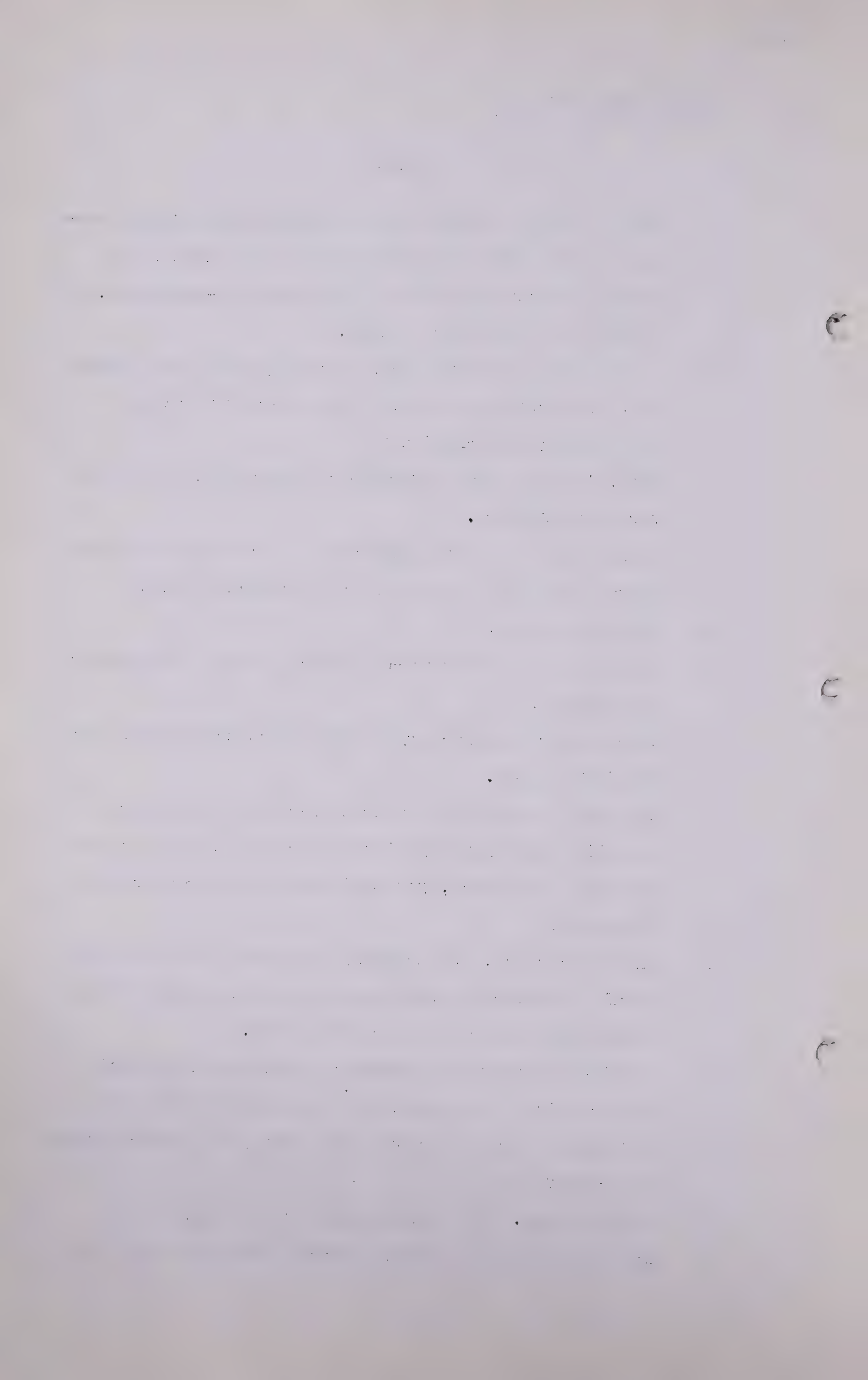
Q And then you have got an area which you classify as probable where you say with more control, more or less additional evidence, you will move it up from probable to proven?

A That is correct. We actually considered that the sum total of proved and probable is the equivalent of the established reserves set by the Board.

Q I think you told me a moment ago that you would not characterize it as probable if you had the type of information that you have about what you characterized as proven?

A That is true. It is a question of shading.

Q And it is delicate shading perhaps from the top of the



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probable to the bottom of the proven?

A They are all relations.

Q There is the lowest grade, which is the bottom of the possible, and there is the highest grade, which is the top of the proved, and you have got shadings right down from the top to the bottom?

A That is quite correct.

Q That is what your definitions mean?

A That is right.

Q Now, your probable, I take it, includes shadings then from the top of the possible to the bottom of the proven?

A Oh, I think that is true.

Q Well, I think we will leave it at that. Take Pincher Creek, the total volume of reservoir rock which you estimated there to be saturated with gas - you have information from three wells -

A Plus seismic interpretive maps.

Q Yes, and from that information that you speak of you found an area of 14,409 proven acres?

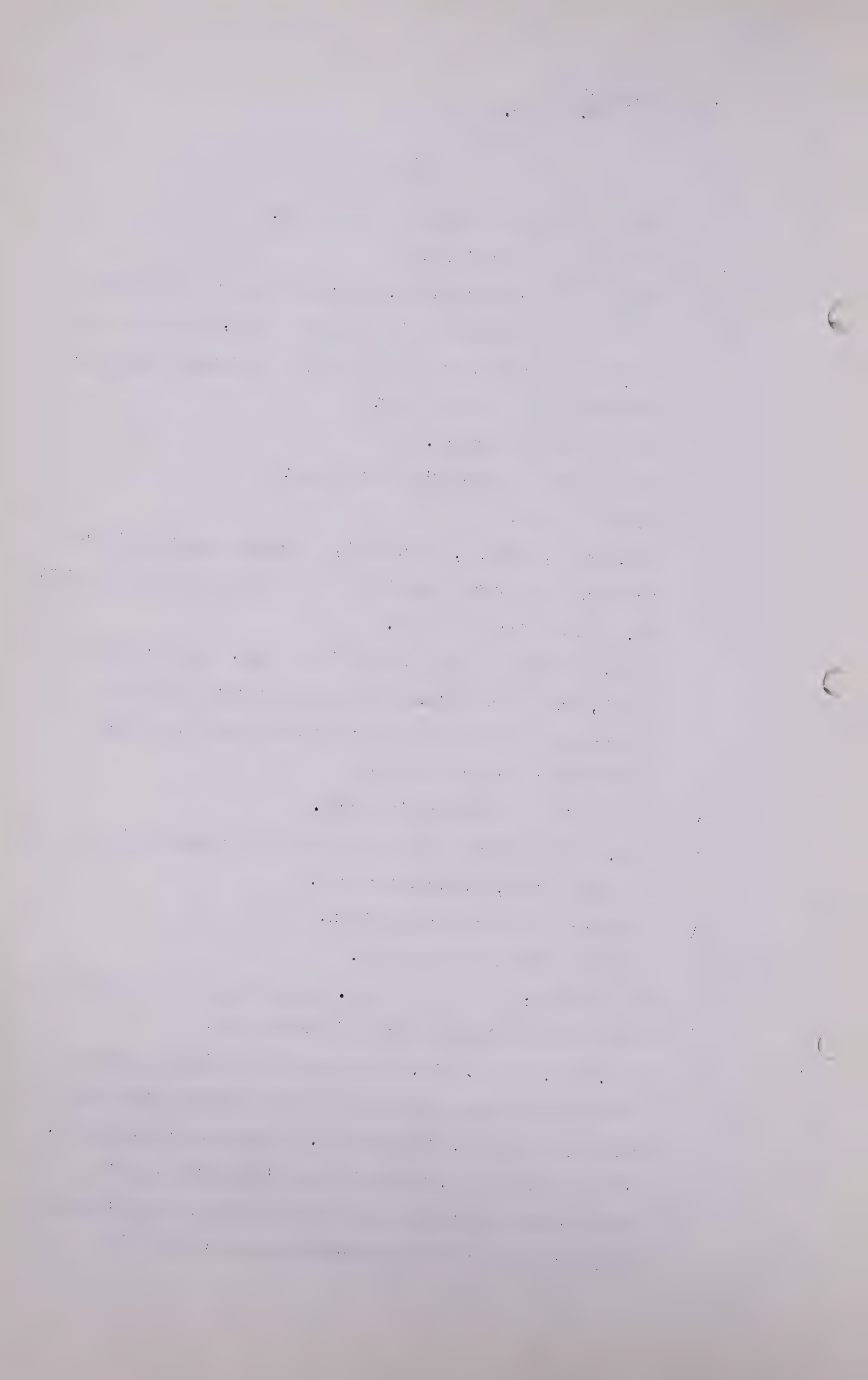
A I assume that is a repetition.

Q I would rather you tell me.

Q DR. GOVIER: Mr. Dougherty, is all the information on Pincher Creek in Exhibit 4?

A Yes, sir, it is. 14,409 would be the widest proved extent of the most extensive of the zones because the underlying zones, for example, on page 4 of Exhibit 4, census division 2, you will note the middle, hard crystal and lower zones are not as widely proved because they are closer to the gas-water contact than the





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central part of the structure.

Q Well then, how much do you deduct from that 14,409? In other words, you have certain horizons extending over 14,409 acres, have you?

A The upper dense and the upper porous zone, yes, sir.

Q And then as you go lower down, the horizons are not so extensive?

A They dip below the gas-water contact so that the total area is reduced to 9,991 acres.

Q That would mean, then, with regard to some horizons we could take 14,409, and with regard to other horizons we have to take 9,000 odd acres?

A That is correct, yes.

Q Now, the 14,409 proven acres, I am told, work out at 263 billion cubic feet, if we take all the horizons?

A I do not quite follow that. You mean, the void space? I am afraid I did not follow that question.

Q Let us forget it for a moment because I have been assuming that we are talking about 14,409 acres. You have pointed out where that has got to be qualified with regard to certain lower horizons.

A Oh, yes.

Q Let us deal with 14,409 proven acres. That, according to my instructions, is 6,049,516 acre feet. You have not got a slide rule?

A I see where you are taking those figures from page 4, census division 2, Exhibit 4-A. That is the sum total of the acre feet in the upper dense and upper porous zones in 14,409 acres and 2,321,908 acre feet under





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9,991 acres of the middle, hard, crystal and lower zones,  
it is a composite void space.

Q And there are 43,560 square feet in an acre, would that  
be right?

A Yes, I think so.

Q And we can make the necessary computations ourselves?

A Yes, sir.

Q I would like you to tell me, Mr. Dougherty, what volume  
do you think of reservoir rock was examined in order to  
get that proven area? Would it be 600 cubic feet?

A I have no idea.

Q Where would we get that information?

A I don't know. I do not think when you have got it it  
would mean very much.

Q I see. You yourself have not examined any of the rock  
at Pincher Creek, am I right in that?

A That is correct.

Q Your information with regard to Pincher Creek as to area,  
as to sand thickness, as to porosity, as to connate water,  
would all be obtained from the Gulf Company?

A That is correct.

Q Now then, you claim in Pincher Creek what quantity of  
proved gas? I am not sure whether you say 19,000 proved.  
I think you do, don't you?

A Well, that depends upon the category you wish to put it  
in. Reference to page 4, census division 2, of Exhibit  
4, column 14.

Q Column 14?

A Yes, sir. Under proved we have various categories.



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Line 16, total initial gas in place 2,316,965 million cubic feet. Then by the appropriate deduction we ultimately came to an estimated recoverable gas reserve available for sale, line 23, of 1,388,969 million cubic feet for that part of the category.

Q Yes, but you say there ought to be added to that part of the category as available for sale all probable, do you?

A Yes, sir.

Q Which would give us 1,543,310?

A That is correct.

Q And your figures with regard to Pincher Creek were as good or bad as this, does it come to that?

A Probably no worse, I would say.

Q You agree, I suppose, Mr. Dougherty, that the degree of proof of the amount of gas that is recoverable from the field varies widely from field to field?

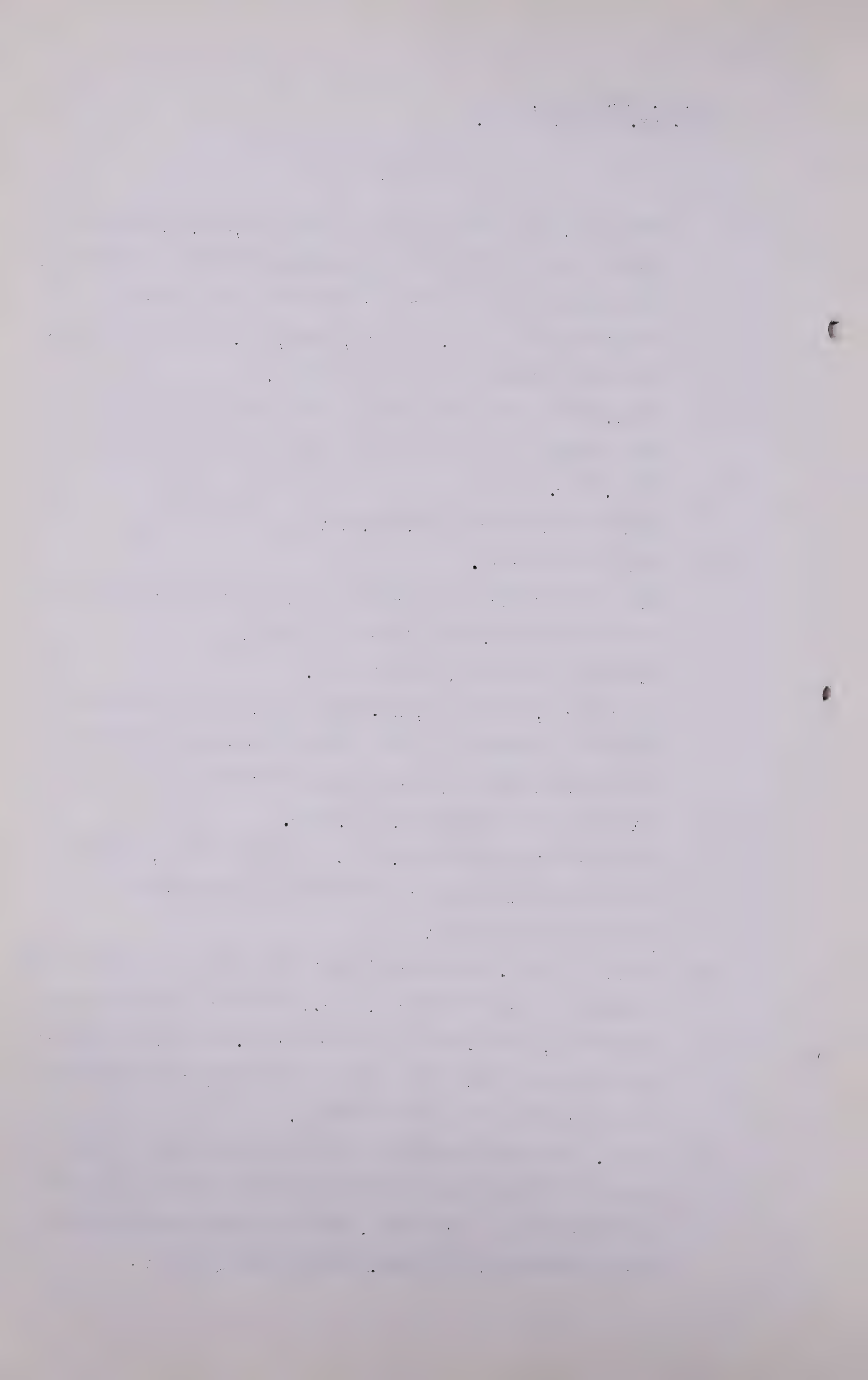
A And with the estimator, yes, sir.

Q And with the estimator, yes. In other words, it varies with the soundness of the judgment of the man who is looking at this gas?

A That is true. We fundamentally think that the facts which you get by core analyses, etc., are merely hand rules to judgment, as Mr. DeGolyer phrased it, They are not much good as individual items else we would put our clerks to work and solve all our problems.

Q Yes. The best estimate you would get as to gas reserves would be from a fully developed field, one that has been producing for a long time, one where the pressure decline can be actually measured, would you say that?





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A No. I would say the best estimate would be when the field is depleted and as a post mortem you have the total accumulated production.

Q Well, I guess that is right. But unfortunately we are dealing with fields that are not completed and we have to try and find the amount of gas left in it.

A That is right.

Q And if that is our problem, I suggest to you that my statement would be correct.

A No, it is not that simple. There is nothing that simple about estimating reserves.

Q Now, Mr. Dougherty, you told me that your estimators had to apply judgment data, didn't you?

A Yes, even figures of pressure decline, even if they are of long standing.

Q I am suggesting to you you would have more confidence in your results in cases where you have got a long production history in a fully developed field and the history of the pressure control than you would get from any other field. You won't agree with that?

A That is a fair assumption. It is a matter of degree again, though.

Q Yes. In such fields as the Panhandle field or the Munro field, these fields are both defined fields, aren't they?

A After a fashion.

Q I see.

A Extensions have been made in the Panhandle field in the last two years.

Q What about Hugoton?





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A The same holds there.

Q Extensions there?

A Yes, sir.

Q Munro?

A I am not so sure about Munro but I rather think that  
there have been small additional areas.

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Q Where would you go in the United States to find a field defined, we will say, to the extent that Viking-Kinsella is in this Province?

A I would say the Panhandle Field would be better defined than Viking-Kinsella.

Q Very well. And the Monroe Field?

A Yes.

Q Better defined?

A Yes.

Q And Hugoton?

A Perhaps about in the same category.

Q I see?

A Those are very generalized.

Q Now, in the case of all of those fields, you would be able to get ample information as to production and pressure decline, is that right?

A Yes, sir.

Q I am suggesting to you that if you have those elements present, you are going to get a much more accurate estimate of proven reserves than you will in the case where some of those elements are lacking?

A That might be, but I would like to make this observation, that I have seen estimates of the Panhandle Field made within at least the last ten years that differed by 35%.

Q We have lots of them here?

A So that I mean it comes to a function of the details and the manner in which the work was done, judgment, etc.

Q All right. Now, I suppose you would agree that with regard to fields like Viking-Kinsella, Turner Valley and Bow Island, we have got much stronger evidence of the





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reserves than we have in such fields as Pincher Creek,  
or Jumping Pound or Morinville?

A Oh, I would think so, yes.

Q Yes. And you are aware of the wide differences in the  
conclusions reached by geologists as to the reserves in  
those fields covered by stronger evidence, namely, Viking-  
Kinsella, Turner Valley and Bow Island?

A That is correct.

Q And since all these geologists have the responsibility  
of reaching some conclusion, they must have given consider-  
ation to all available data?

A There would be variations in that, but we can assume that.

Q I think you can assume that the gentlemen who appear here  
would consider all the available data, don't you?

A Not necessarily.

Q You know who they are?

A Yes.

Q You are speaking from your knowledge of their methods of  
doing their work?

A Oh, I am speaking from the knowledge of the methods we used  
in our work.

Q Yes. You have had a wide experience in estimating reserves  
available to natural gas pipeline companies for financing  
purposes?

A Not wide, but a considerable amount.

Q Would you mind telling us some of those and when they were  
done?

A The natural gas pipeline - do you mean personally or the  
efforts of DeGolyer and McNaughton?

A I think perhaps we better start with you first, if you care to,





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and then supplement it, if you care to supplement it, we will be glad to hear it?

A The application of a natural gas pipeline company some time in 1946 to take gas from the Hugoton Field, the acreage designated as Hagy, Herrington & Marsh, in Oklahoma to Chicago, Illinois.

Q Yes?

A This involved a major looping and projecting, in fact, a new line, and the reserves were on the order of 800 billion cubic feet, I believe.

Q Of what type of gas?

A Recoverable pipeline gas, available for sale.

Q Which?

A Recoverable pipeline gas, available for sale.

Q In other words, absolutely proved gas?

A No, sir, in this same category we have here.

Q I am going to ask you about that in a moment, and we will see.

THE CHAIRMAN: I think, Mr. Steer, this would be a convenient time to adjourn.

MR. STEER: Yes, sir.

(Hearing resumed after short adjournment).

Q MR. STEER: You were going to tell us about some of the estimates, Mr.Dougherty, that you and your firm have made for finance purposes?

A Yes, sir. I believe the second one.....

Q For gas pipelines, of course?

A Yes, sir. I believe the second estimate would be an estimate for the City Service Gas Company of Oklahoma City, for a



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looping of the lines to Kansas City, involving the acreage of Magnolia and Stanolind in the Hugoton Field, involving a total of approximately 2 trillion feet of pipeline available gas.

A Yes?

A That was in 1946.

Q Yes? Well, you would have these and other instances?

A Yes.

Q Where you have estimated reserves?

A Yes.

Q Now, in all cases were they classified as proven, probable and possible?

A No, sir. I think we just had a lump sum total available for sale.

Q Pipeline gas?

A Yes, pipeline gas.

Q So that you do not have the same classification as we have here?

A We do not go into as near as much detail.

Q I see?

A There is no necessity to break down our entire processes of thinking on it. They have been familiar with our work for some time.

Q And these projects went before the Securities Exchange Commission?

A The Federal Power Commission and then the Securities Exchange Commission.

Q Yes?

A And, I assume, the banking houses.

Q And those bodies would not have before them any estimate of proven, probable or possible gas reserves on which to





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exercise their judgment, is that right?

A They have the estimates of DeGolyer & McNaughton, which is usually sufficient.

Q And DeGolyer & McNaughton gave them an estimate of pipeline gas?

A Yes, sir.

Q Do you think that Canadian Delhi at the present moment have a sufficiently sound position with respect to reserves to enable Canadian Delhi to finance a line from Alberta to Montreal?

A That question cannot be answered, because my understanding is this, that there is no reserve dedication, or that there are no reserve dedications as such.

Q I see?

A In any of these proceedings, and no one, in fact, has title to them, that is, no one but the developer or whoever holds the lease.

Q Yes. We, of course, have here your report in which you point out that 4 trillion, 4.4 trillion of it is, so far as your report is concerned, dedicated to Trans-Canada, is that right?

A Their proposed gas supply. There is no dedication implied.

Q What I wanted to ask you was, whether, assuming that Canadian Delhi had those fields, you believe that they are in a sufficiently sound position to justify their building a pipeline from Alberta to Montreal?

A I do, yes, sir.

Q In other words, they need 4.4 trillion feet of gas to justify it?

A No. That is the sum total of what those fields estimated at.





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I do not have in mind what it actually takes to justify it. We did not cut and fill in there to come up with any certain figure.

Q I see. So that the 4.4 trillion is not the quantity that is required for Trans-Canada?

A I think that point will be brought out in Mr. Trostel's exhibits, because it relates to the total availability, and then I think the answer will be quite clear that it is sufficient.

Q I see?

A But we did not cut and fill and tailor and keep adding those fields to get sufficient reserves.

Q I see.

A We took these fields early in the life of this project.

Q I wondered why in certain Census Divisions, which are in a common area - the fields in the Census Division are in a common area, are they?

A Well, I assume so. The Census Division incorporates an area.

Q Yes? I have been wondering why you pick out from Census Divisions, in some cases, certain fields only to give to Trans-Canada and leave the rest?

A Trans-Canada, or Canadian Delhi, supplied us with a proposed pipeline route within the Province of Alberta.

Q Oh?

A And in their preliminary work laid down basic areas and fields from which the proposed supply was to be taken.

Q I see?

A We then built that into, attempted to build that into a



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comprehensive picture of a sufficient availability to take care of the estimated projected commitment, or the pipeline capacity, I mean to say.

Q All right. Then if I take Census Division 3, in which you dedicated certain fields, if I may use the word "dedicated".....

MR. PORTER: Do not use the word "dedicated", because it is not dedicated. That is what the witness tried to tell you.

MR. STEER: Perhaps the witness and I will understand what I mean by dedicated. If you will give me a word I might use it.

A Well, our proposed supply gas field.

Q MR. STEER: You and I understand what I mean by "dedicated"?

A Yes, sir.

Q All right. In Census Division No. 3 certain fields were proposed as a gas supply for Trans-Canada, and certain other fields were left, and do I understand that the fields that were proposed for Trans-Canada are the fields that you thought could be economically gathered by this proposed pipeline?

A No.

Q No?

A No.

Q What is the basis on which some fields were included and some were omitted? Now let us look at Census Division No. 3. How many fields are there in Census Division 3?

A Fields or prospects, there are 26, as set out on page 3, Census Division 3, Exhibit 10.





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Q Yes. And you proposed for Trans-Canada eight of those fields, am I right in that?

A That is correct. It is shown on page 4.

Q Now, my question, Mr.Dougherty, is why you do not take all the available gas in Census Division 3 rather than just from those eight fields?

A Those fields centre around the proposed route of the line, heading at about the main compressor station in the vicinity of Princess, as proposed in the original application of Trans-Canada, so that we take as our initial - mind you, this is the initial proposed program, the initial proposed field; it is not fixed or final for all time, but the starting basis - we take the eight fields centering around the Princess area, we took them, which had no substantial development of reserves, Countess, Patricia, Brooks northeast, Princess proper, Rainy Hills, Steveville. You will note there that they are in close proximity to the Princess area as supplying what pipeline engineers have said is an initial take in the initial stages of the study.

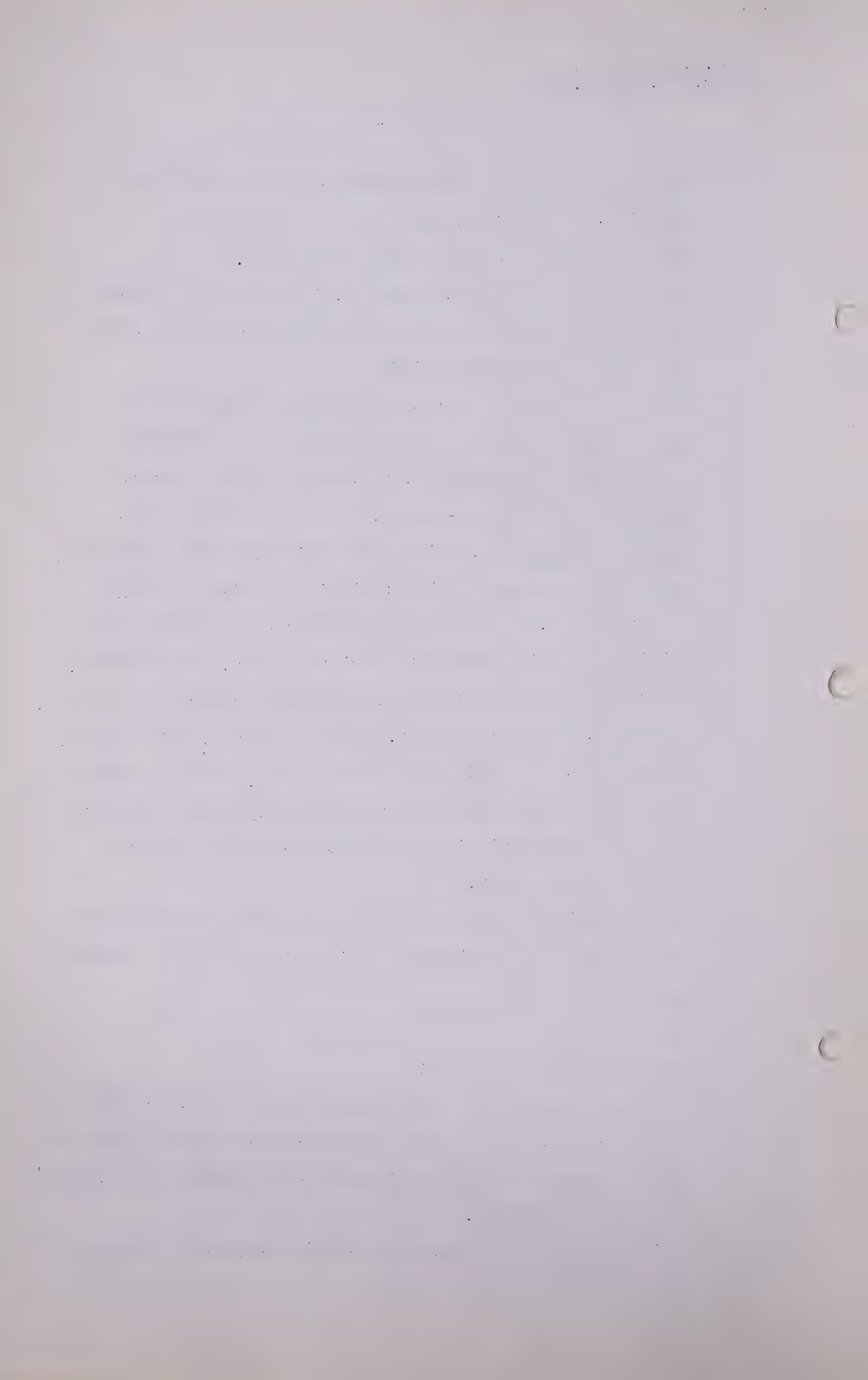
Q What is going to be done with the gas from the remainder or the rest of the fields, is it going to be left undeveloped?

A Oh, no.

Q What is going to be done?

A The export market for such gas may well be found in the export system, but at this time we do not need to take the entire reserves in Census Division 3 to satisfy the proposed initial requirements.

Q Don't you think you would be better to take the gas from



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those fields than from Morinville, 18 miles from Edmonton?

A No.

Q You do not?

A No.

Q I see?

A That was not the proposed line system.

Q I see?

A The line system was proposed before this work of the estimation of reserves was begun by DeGolyer & McNaughton.

Q You mean the pipeline system proposed by Trans-Canada?

A Yes, sir.

Q And your whole allocation, if I may call it, or your whole proposal as to the reserves for Trans-Canada, is based on the location of that pipeline?

A That is correct.

Q Yes?

A They took reserves which have no market, and we feel that the trend of the pipeline system, the trunk gathering system, is in the area most likely to have a very abundant supply of gas.

Q Is that so?

A Yes, sir.

Q Do you know how much money Delhi has spent up to this time in Canada in the search for gas?

A No, sir.

Q What do you think would be required in the form of money to build this line from Alberta to Montreal and supply it with its necessary quantities of gas, have you any idea?

A I have no estimate, no, sir.

Q Is Delhi proceeding on your recommendation, or are you





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simply employed to do a specific job?

A We are employed to do a specific job.

Q So that they are not acting on your recommendation?

A In some minor cases I think they have seen fit to utilize some of the views expressed in these exhibits in their development or exploration. I have had discussions with Mr. Schultz on a number of occasions, but it is a relatively restricted sphere.

Q So that I understand that Trans-Canada designs a route for a pipeline, gives you that route, and tells you to go and find the gas that will justify a pipeline to Montreal?

A No, sir. My understanding of that is that there was preliminary work done before DeGolyer & McNaughton came into the picture on reserves, which indicated to Canadian Delh; the approximate location of the line, the general knowledge of the fields and the general geology.

Q So that this is the situation, so far as you are concerned, that you were given a route for a pipeline and you were told to come up here and make an independent examination of gas reserves that could supply that pipeline with a sufficient quantity of gas to justify construction to Montreal?

A I do not think it was ever set out in those terms.

Q No? .

A I would say that the essence of any pipeline project is that.

Q Yes. Now, then, I want you to look, if you will, at Exhibit 10, and you summarize there in your summary, you summarize the reserves - I do not know that I need to go through the figures again - you have proved reserves



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of 8,553,316 million, is that right?

A Proved as of August 1st, 1951, yes, sir, for the Province.

Q And probable of 2,509,517,000,000?

A That is right.

Q Making a total of 11,062,835,000,000?

A Yes, sir. No, 11,062,833,000,000?

Q 11,062,533,000,000?

A Yes, sir.

Q That is right. Then you have possible gas of 2,644,623,000,000?

A Yes, sir.

Q And available for sale of 8,415,442 million?

A That is correct, except for that deferred production which would be available for sale in the future.

Q Now, then....

Q THE CHAIRMAN: Does that 460,773 give you the total of 8,415,442,000,000, that is in your summary there?

A No, I do not believe it is in that. It is deferred. In other words, it does not appear in the available for sale column as of August 1st, 1951.

Q So that it is not included in the total figure?

A No, that is deferred in all respects.

Q MR. STEER: Now, when you refer to your summary for Trans-Canada pipeline requirements, where do I find that?

A I believe that is in the following section, the next sheet.

Q All right. You headed this, and I want to be clear about what you are doing here, "Summary of Natural Gas Reserves of Proposed Gas Supply Fields of Trans-Canada Pipe Lines Limited". Now, I take it that Trans-Canada Pipe Lines





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Limited has an application before this Board for an export permit?

A That is right.

Q That is right, you know that?

A Well, I am not sure of the legal status of all this.

Q Well, assume that they have, Mr.Dougherty, you are saying to the Board, so far as this submission goes, Exhibit 10, you are saying to the Board, "You ought to give us an export permit because we can take gas from Alberta to Montreal if we get this 4, 407,090,000,000 cubic feet?

A These reserves that have been so chosen or equivalent reserves which would serve to supply the proposed pipeline, yes.

Q Yes.

A Because there are no dedications of gas.

Q Quite so.

A This is a proposal, not fixed.

Q So that it may be that we may anticipate you coming in at a later date and saying "We do not want these particular reserves that make up this 4 trillion odd cubic feet, we will take certain other reserves and leave those for the use of the Province"?

A Well, that could occur, because there may be a field developed, another foothills field, which will offer high deliverability, which will be advantageous both to the Province and to an export company.

Q Yes?

A There is a lot of variation that could occur, as reality goes beyond all present proposals.

Q Now, you are familiar, I have no doubt, with the estimated



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reserves of gas that are already committed in the Province to the Edmonton and Calgary distributing companies, and to other smaller undertakings?

A In a general sense, yes, sir.

MR. PORTER: Now, just a moment, if you will pardon me. I personally know of, do not know of a single foot of gas in the Province of Alberta that is committed to anybody, having regard to the fact that the disposal of gas in this Province is going to be the subject of this Board's order, and always has been. Now, on that basis I do not like discussion of gas that is committed. It may be proposed that gas will be used by them or other utilities, it may be that one of them owns some gas. As I understand the function of this Board, and the declared intention of the Legislature, it is to give the greatest possible freedom of action to the Board to allocate gas as it chooses, the concept being that we are going to minimize the cost to the domestic consumer by whatever means are necessary. Now, on that basis, I object to the question being put to this witness on an assumption of something which, I submit, does not in fact exist.

MR. STEER: Well, I might say, Mr. Chairman, that what I am endeavouring to do is to understand what this proposal is, because as I go on, I am afraid I am becoming more and more confused.

Q Let us see if we can clear it up, Mr. Dougherty. You have got 17 Census Divisions here in which you estimate gas reserves?

A Yes, sir.





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Q That is correct?

A Yes, sir.

Q And with regard to eight of those Census Divisions, and perhaps you will make a note of these, two....

A I think they are shown on that sheet, 2, 3, 5, 7, 8, 11, 14 and 16.

Q Quite so. All right. We have got 17 Census Divisions, and with regard to those that are shown on this Summary of Trans-Canada reserves, as it is called, you take for the Trans-Canada reserves gas from eight of those Census Divisions?

A That is correct.

Q Yes?

A We proposed those as the gas supply fields.

Q I see. And you nominate them as the Trans-Canada reserves?

A Proposed gas supply fields.

MR.PORTER: What page is that? I do not see any "Trans-Canada Reserves".

MR. C. E. SMITH: It is on the heavy index thing.

MR.PORTER: On the heavy index. Well, well, we had to go hunt for that one.

MR. STEER: I hope you will have to hunt for more.

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Q Now, then, let us go over the 17 Census Divisions, Mr. Dougherty. First of all you do not propose taking any gas from Census Division No. 1, which includes the Pakowki area?

A As of this instant?

Q Yes, as of this instant? and that is the only way the Board can look at it?

A I am not so sure. We might disagree on that.

Q Let us canvass that for a moment.

A I say that the Board should lengthen the range of the evidence at the proceedings. I think I would in their position. And no reflections.

Q But the Board has got to make a permit order as of today and not as of some subsequent date, has it not?

A What will happen in the future?

Q True, if they want to speculate. If they want to speculate on what is going to be brought out of the earth.

A Just as the markets are speculative for 30 years, yes, sir.

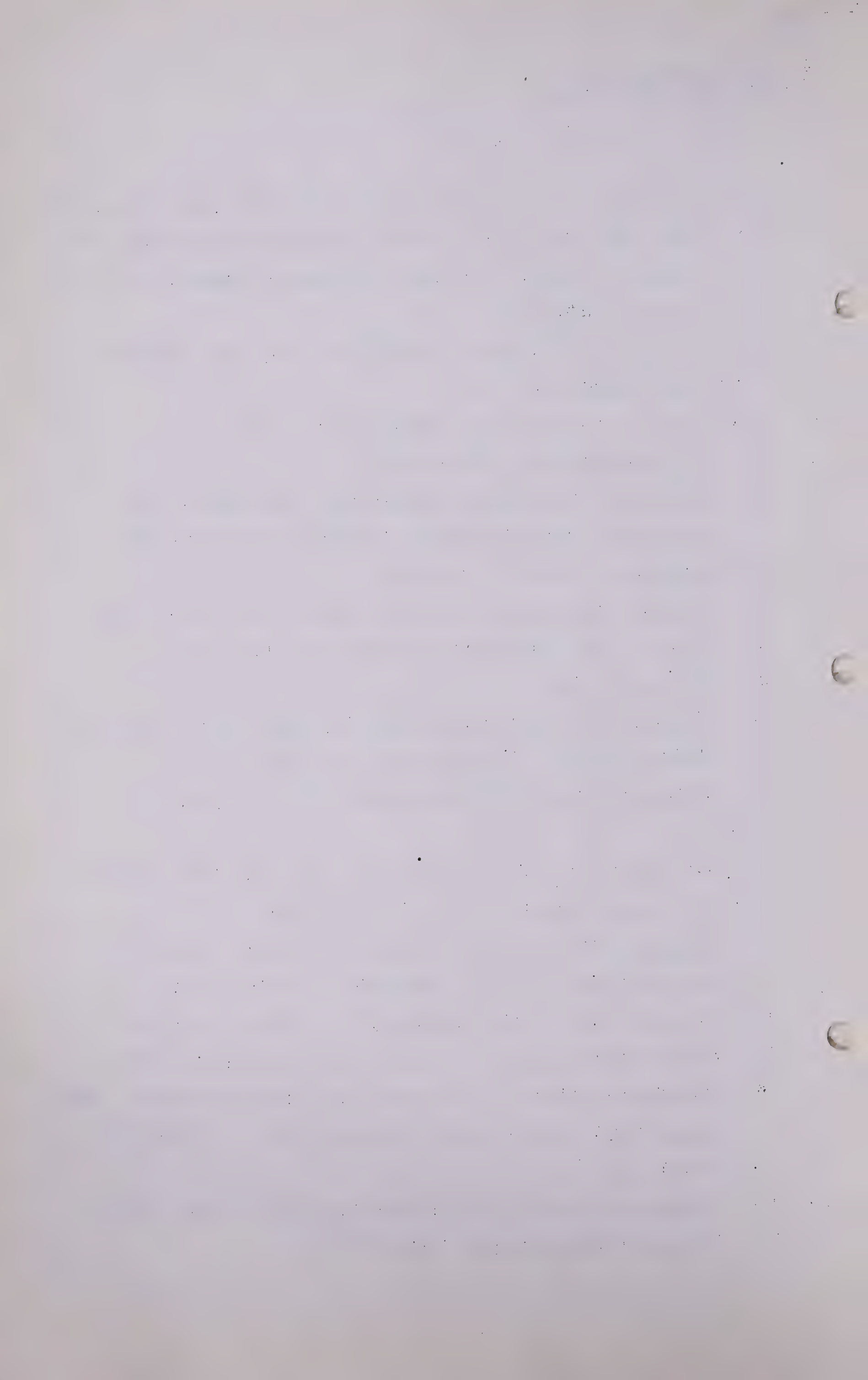
Q I wonder if that is a function of this Board that is here to protect the interests of the citizens of Alberta to speculate on what may be found in the way of a gas supply that is considering 20 years hence. Do you think that?

A I would never close my mind as at any time on any question.

Q I am wondering what the Board ought to do, charged with the duty of protecting the citizens of this Province. What ought they to do? Ought they to speculate or ought they to be sure?

A I know of nothing that is not speculative to some degree.

Q You will not answer that question?





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A I do not think it can be answered.

Q I am suggesting to you that the Board ought to have proof satisfactory to it of the supplies for this Province, accessible supplies at the cheapest possible price over a period of 30 years at least before they permit export of a foot of gas. Do you agree with that?

A I understand that is the essence of the Act under which the Board is operating. I assume it will interpret that in the lights of their own desires.

Q All right. Now let us go over this list together. The first, as I say, is Census Division No. 1 which includes Pakowki.

A That is correct.

Q I suppose that is the reason you do not include it or is it, because that is committed to the extent at least of 45 billion to the Montana Power Company?

A As of this instant, that is correct.

Q You do not claim anything there or propose?

A That is correct.

Q You propose the whole of Pincher Creek?

A Yes, sir.

Q Am I right in thinking that the reserves in Pincher Creek amount to 23% of your 8.4 trillion cubic feet?

A It may be. I have not made such a computation.

Q I am suggesting your Pincher Creek reserves amount to 23% of your whole 8.4 trillion cubic feet?

A That would depend on which category you are discussing, available for sale or proved. It is a substantial portion.

Q And if we compare that with what the Board finds, 4.568



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trillion, it would be a much larger percentage, that is obvious?

A Comparing my figures and the Board's figures?

Q Yes?

A Yes, sir.

Q Comparing the company's estimate of reserves with the Board's?

A Well, my estimate of reserves and the Board's estimate, yes, sir.

Q It looks as if it would be one-third of what the Board says exists in the Province, of marketable gas?

A It would be something like that.

Q Comparing the 4.5 and the 8.4. Now, then, we come to Census Division 3 and as I pointed out, you propose for Trans-Canada 8 fields?

A That is correct.

Q The rest of it is up in the air unless some distributing company wants to run a pipe line out there and collect it. That is so, is it not?

A At the moment.

Q That is what we are looking at. We are dealing with this thing as of today. Now, your No. 4 Census Division includes Turner Valley and you have not proposed anything for export from Turner Valley?

A No, sir.

Q No. 5 you have, I think, proposed to take the lot. Cessford, Sunnybrook, Craigmyle and Hanna, am I right in that?

A That is not the lot.

Q There is quite a lot there that is left just as in





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Census Division 3?

A That is correct.

Q All right, 6. Jumping Pound. You do not propose anything there for export, and then Castor and Provost in Census Division 7, what about that? Is there some left there?

A I think Coronation and Bulwark and Alliance and some of the minor accumulations are not considered.

Q Now tell me why you would divide up these Census Divisions as included in certain areas adjacent to one another. You take out a certain quantity of gas and leave the rest to be gathered by anybody else in an expensive operation?

A As a proposal as of the present time which in essence cannot be related far into the future without change. We have in mind, in my own thinking for example, in Census Division 5, that Oyen and Sibbald would form together in the future a convenient focus for a trunk pipe line system, a gathering lateral which could be used for either Provincial or Trans-Canada needs or someone else's needs. We have to keep a very open mind on future amounts with respect to any proposed allocation as of this date.

Q What I am wondering is how open the Board's mind has got to be?

A I have no doubt about that myself.

Q You have no doubt about what, about the Board's open mindedness?

A Yes.

Q Neither have I, but how open has it got to be to state what the possible future gas obtained will be?



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- A I think we will rest on the possible category. From some of the examples we showed you there is a very high degree of actuality in these reserves. I am not afraid of them although they are included in the term "possible".
- Q Your attitude is that you have to just suggest these figures and the problem of the Board is whether they should accept them or not?
- A I think they will make up their own mind.
- Q You are here to assist them?
- A I am here to present as best I can our opinion on the work we did and nothing more.
- Q The purpose of your being here is to do as you have just described and assist the Board to make up its mind as to the solution it ought to make on your presentation?
- A We have presented our data and it can be integrated by the Board in any fashion it so desires.
- Q Quite so, and you could have answered to my question "yes" and come to the same result. Now, will you look at Census Division 8? You take 4 fields from there and leave the rest, is that right?
- A Yes, sir. Those are immediately on the pipe line route or inter-connected by . . .
- Q I gather that you were given a pipe line route and you were guided in your selection by the availability to those fields.
- A Obviously the pipe line route has a good deal to do with what reserves will be of interest to us in our proposals.
- Q What you are saying is that you have selected the fields

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which are going to feed into this pipe line. The fields are selected on the basis of those that you think economically can feed that pipe line?

A I am not worrying too much about the economics at this stage actually because matters of reserves now, as seen by present data, are more limited than they will be when the economics become a factor of importance.

Q Then if that is not so tell me why you selected Bashaw and Leahurst and so forth and left the rest?

A Those fields have reserves in some volume immediately adjacent to the line. The rest are primarily solution gas reserves in which the gas will be used in the field or perhaps may subsequently be used for local use. We are making an estimate of the Census Division to make a purely coherent picture and that is the reason why all are non-associated. You will note that the reserves are non-associated gas.

Q Have you taken all the non-associated gas in Census Division 8?

A With regard to any gas that is anywhere near the pipe line route.

Q Anywhere near the pipe line route. I want you to tell me whether or not this is so, that you are given a pipe line route and you selected a field which you would consider properly should feed into that pipe line?

A For the initial phase.

Q For the initial phase?

A That is the minimum for the first 1 year, 2 years or 4 years and by the time that period has elapsed you need further



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fields which, together with the existing fields, will make the pipe line laterals very attractive and will bring that gas into the marketable insofar as possible, into the market either for the Province or for the pipe line.

Q Then Census Division 9, the Brazeau area. You do not propose anything there?

A No, sir.

Q The Viking-Kinsella. The reason I suppose is obvious?

A Yes, sir.

Q Then 11. You have 1, 2, 3, 4, 5, 6 and the 6th one being Leduc-Woodbend Lower Cretaceous gas. That is all the gas in 11, is it?

A No, sir.

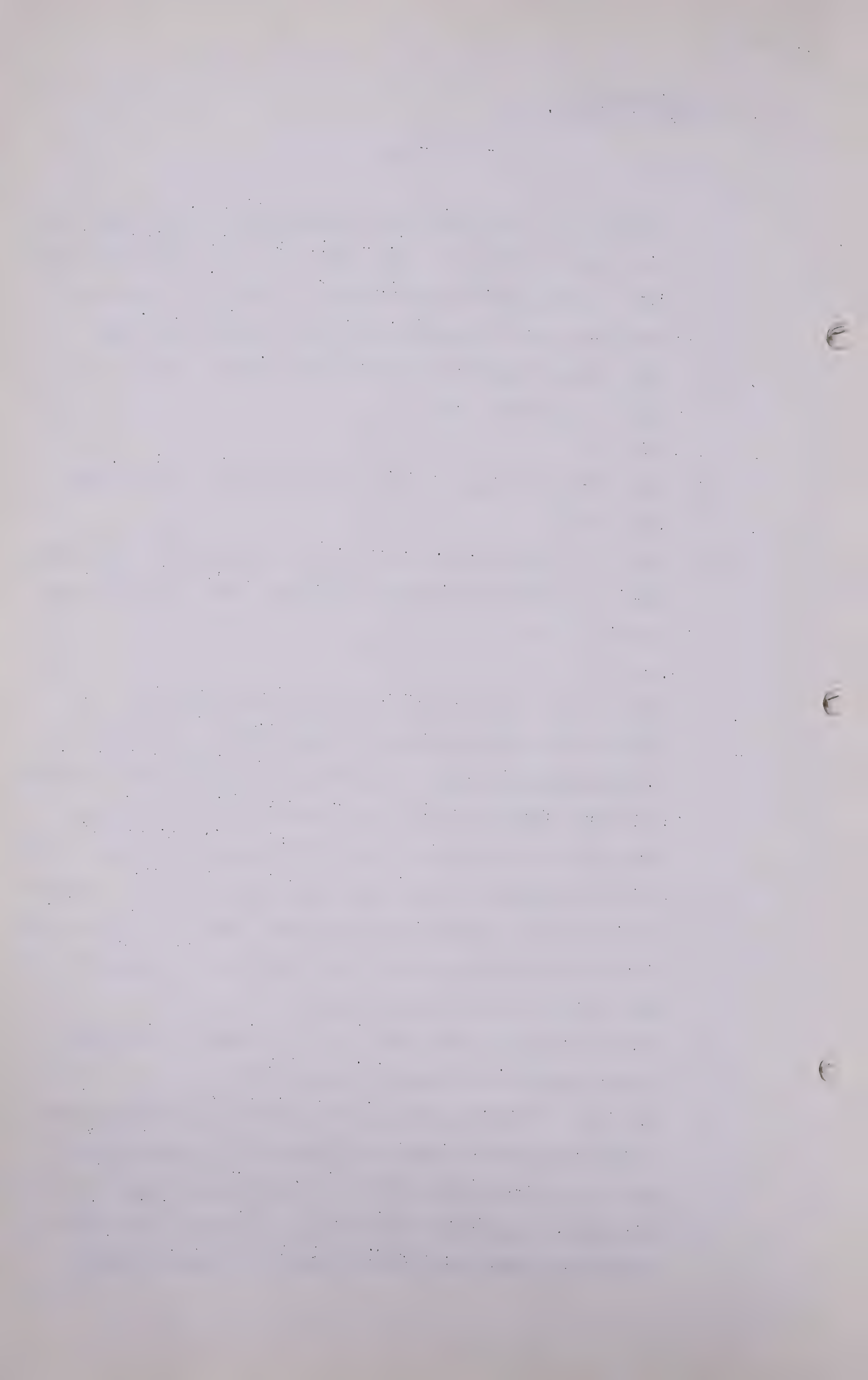
Q Why do you select those areas and leave the rest?

A Those fields have no market at the current time and are non-associated fields. The dissolved gas in most instances is either deferred or will be primarily for field use. They are not subject to sale to the pipe line at the time of this proposal. They might be 5 years from now, due to additional development and then there would be a determination as to whether it was more feasible to transport that gas or use it for local consumption.

Q Do I understand that these six areas are the only non-associated gas in Census Division 11?

A No, sir. They are almost the greater part that we had sufficient data to make an estimate on because we have put the Legal-Morinville area in 14 because Legal is in 14.

Q Chip Lake, Coal Spur and Muskeg you make no claims with respect to them, nor for Elk Point? I suppose their





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distance from the pipe line route would be the distance there, would it?

A We propose no laterals anywhere near those at this stage of the proposition.

Q Your suggestion is that the Board ought to give a permit now based on those supplies and then if things turn out that some of those supplies ought to be taken for local consumption and substituted by supplies from other areas which have been developed in the interval, that is all right, that is your suggestion?

A I would say that is the Board's decision. I am making no proposal in that regard.

Q Is not the whole of your evidence based on that proposition?

A No, sir.

Q It is not?

A No.

Q I understood you to tell me this is a tentative proposal?

A Obviously any proposal at this time is tentative only.

Q The Board's problem is not tentative. The Board's problem is to find whether there is a supply of gas for 30 years and whether there is still gas for export.

A I think the Board understands the problem. I do not need to interpret the problem.

Q I am not talking about whether the Board understands. I am trying to understand how I have to approach this problem.

A I think we are getting at it in a reasonable manner.

Q Is not your proposition this that you put forward here a tentative proposal that the Board can today give a permit, do you say that?



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A It is put in on the basis for their judgment as to when and if a permit should be given.

Q You are here, Mr. Dougherty, after wide experience in this kind of work . . .

MR. PORTER: What kind of work? Surely the evidence this witness gave was that by the examination of certain geological information which is in these trunks, trunk loads of it, he arrived at certain conclusions. Now, we can cross-examine on that evidence under the rules and say or show that he did not know what he was talking about, that he had wrong data or that he has drawn wrong deductions. Now he is being examined for the purpose of showing Board's policy, Company's policy and physical proposals. You can go on indefinitely and I do not care how long we go on. It does seem to me while this Board is not bound by normal rules of evidence then at some stage we will reach the point at which the reasons which caused these men to make the rules will be seen, and that was that the cross-examination must be either to establish or break down the testimony which the Board is anxious to accept. The Board is being asked by my client to examine Mr. Dougherty's information, founded on an examination of a great mass of material, that there is in the Province of Alberta for sale 8 trillion cubic feet of gas variously distributed which may be used to supply the Province's paramount needs, always paramount, in the manner that is outlined here, on a tentative basis. Now I suggest that this cross-examination at the policy level is entirely





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irrelevant. This witness did not come here to lay down policy or to fix the geography of lines. He came here with this very excellent study to try and help this Board in determining what is its first determination, is there enough gas here for the consumers of Alberta and then the second determination, which can only be made after the first is abundantly clear, is there enough for an export project.

THE CHAIRMAN: In that case, Mr. Porter, then why did the witness attempt to differentiate between the reserves for the Trans-Canada line and presume the balance for Provincial requirements?

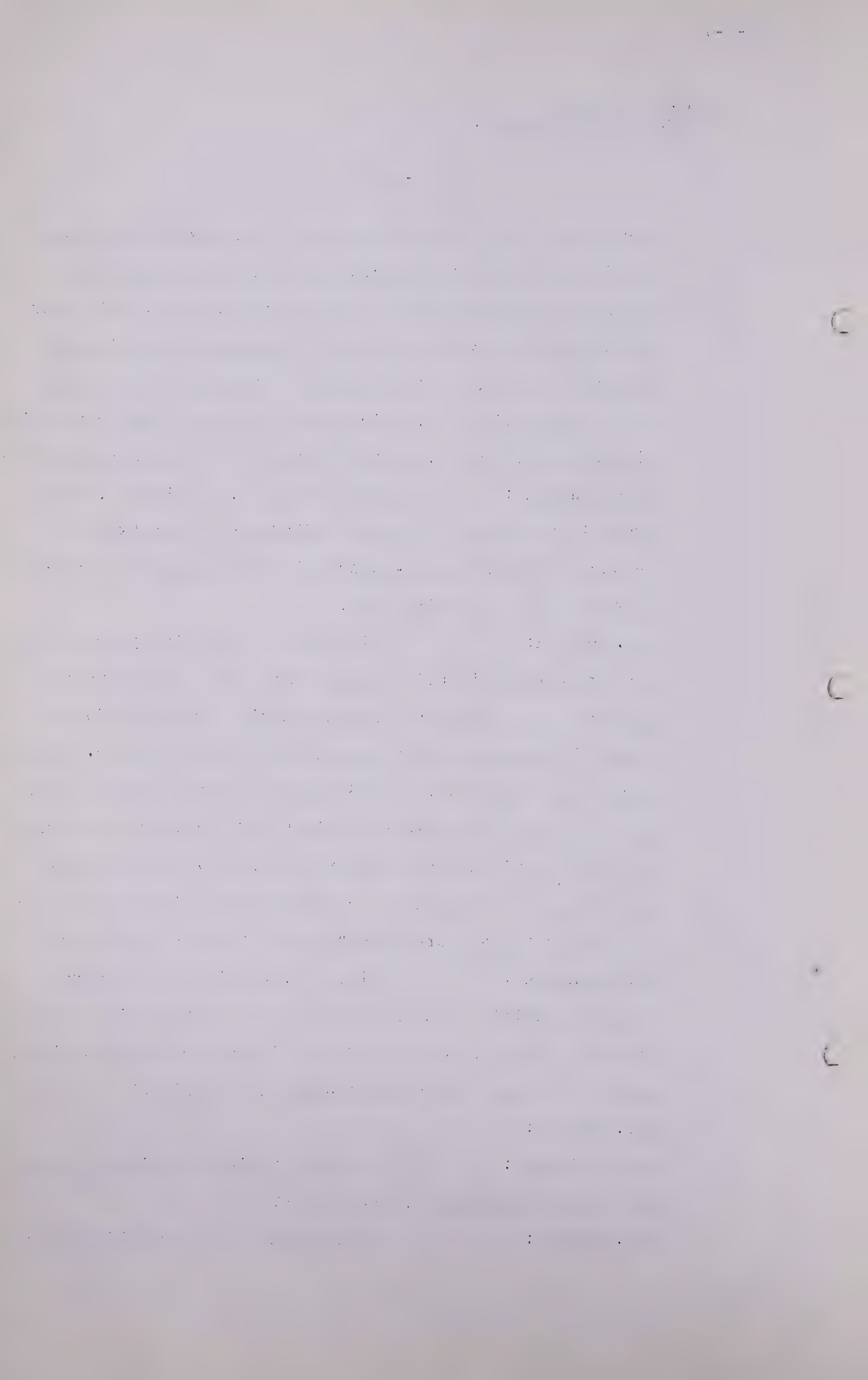
MR. PORTER: I propose to submit by Mr. Trostel an over-all availability study which does not do that. I expect to be in trouble for not having broken it just as I think this witness has endeavoured to make clear. It was broken down this way last September, that is the material into the local and export available fields, purely because as he has said he had to start somewhere. I do not know why the witness should be continually put in the position of having to say more than "we have to start somewhere."

THE CHAIRMAN: I agree, but is not the purpose of this exhibit to assist the Board in determining whether there is surplus gas and if there is a surplus what fields should be given to the Trans-Canada Pipe Lines?

MR. PORTER: Yes.

THE CHAIRMAN: Have we to ignore this altogether, is that what you wish, Mr. Porter?

MR. PORTER: I am going to ignore this entirely



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in the availability study because I think it goes back to a practicability study in an engineering phase.

THE CHAIRMAN:                   Insofar as this exhibit is concerned you say we should ignore it?

MR. PORTER:                    I think that should be regarded as tentative in order to give some information to the Board.

THE CHAIRMAN:                  Then counsel has a right to cross-examine the witness as to how he made this up. If you wish to withdraw this, all right.

MR. PORTER:                    No, I think not. There is no object in withdrawing it, because it could be changed tomorrow and probably will be re-changed the next day as the Board studies it and we study it, but I do suggest that too much emphasis is being placed in the cross-examination of this witness on a tentative assumption made only for the purpose of study when what is being put forward in leading questions is a structure of stone and permanence.

MR. C. E. SMITH:               I suggest we get on with Mr. Dougherty and Mr. Steer only.

THE CHAIRMAN:                  Mr. Steer, will you proceed?

MR. PORTER:                    I was trying to see if we could not get on.

MR. STEER:                    We are getting on.

MR. PORTER:                    It could be.

Q MR. STEER:                   One of the remarks my learned friend made was that there was an issue before the Board of whether or not there was enough gas for consumption in the Province. It is just on that issue, Mr. Chairman,





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that I am cross-examining Mr. Dougherty. Is there on his proposal enough gas for the consumers of the Province? I do not intend to worry you very much further with this, Mr. Dougherty. In 14 you have taken some and left others. Am I right in that? In Census Division 14, or have you taken it all? I guess you have taken it all.

A We have taken essentially all the gas there was. The proposed laterals run up towards Lac la Biche area and towards Normandville and Little Smoky Lake area, and my impression is that there are no local markets except that in the vicinity of Athabasca. The fields shown adjacent in Census Division 14 would give a maximum possibility of getting a market for very substantial reserves which are presently unimportant or have a very real prospect of connection.

Q As I take it, you have taken 7 out of the 24 in Census Division 14?

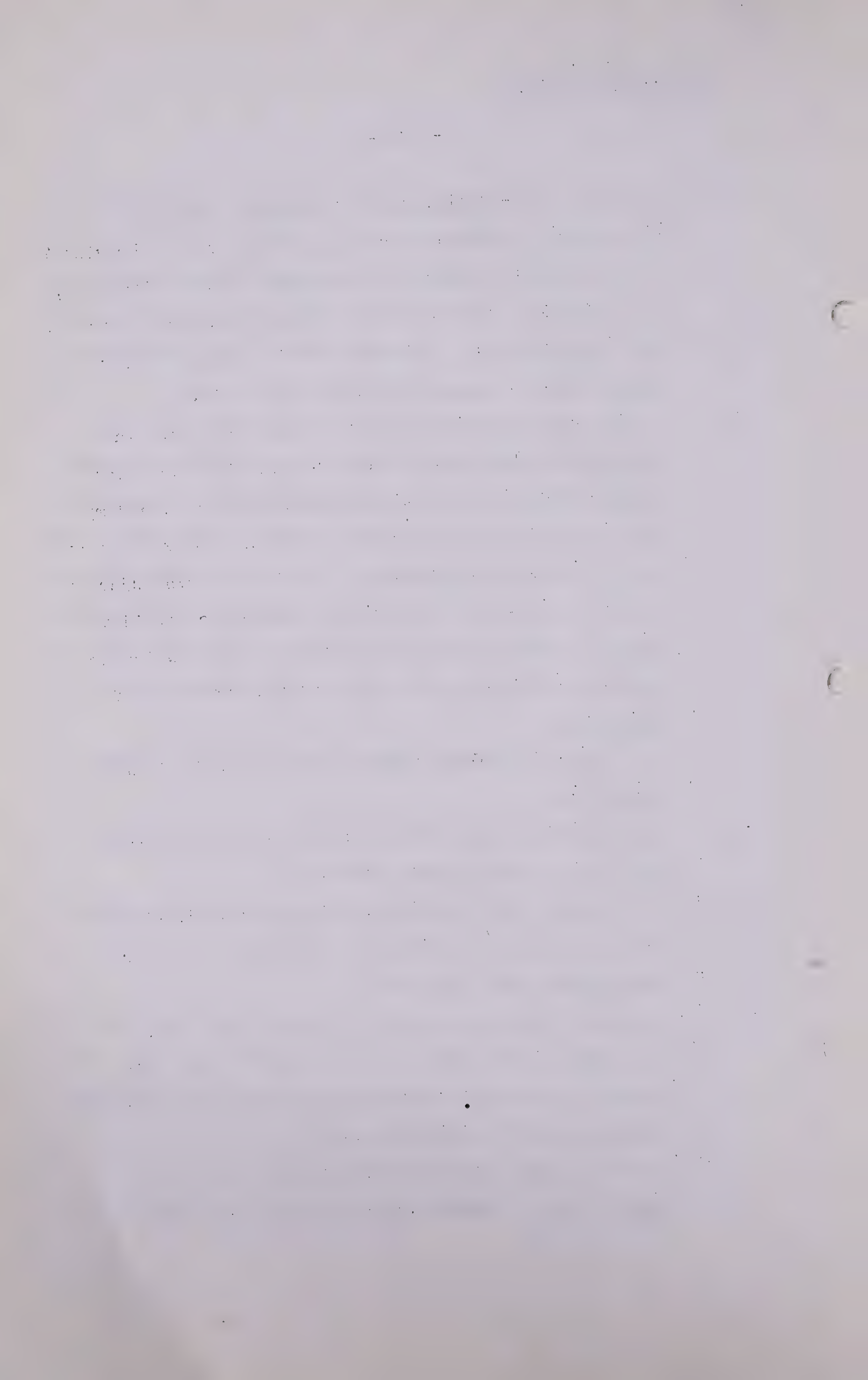
A That is fields and prospects, some of which are very minor and of very recent discovery.

Q In 15 you do not take anything, Falher, Grouard, Little Smoky Lake and Normandville. I suppose they are far removed from this pipe line?

A No, sir. The data is very limited at this time. As you will note in most cases there is insufficient data for estimates and we do not know other than that there are good prospects for additional gas.

Q In 16 you take 2 and leave the rest?

A That is true. There is no, currently, gas going to



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Dawson Creek from Pouce Coupe or Whitelaw nor Tangent which provides sufficient data to make estimates of reserves and availability estimates.

Q In 17 you take none?

A No, sir.

Q Now, Mr. Dougherty, I would like you to take down some figures if you will, having in mind your 8.4 trillion available for sale of which 4.5 trillion is proposed for Trans-Canada Pipe Line?

A No, sir, we are getting into different categories there.

Q Are we?

A Available for sale to Trans-Canada is 4.4.

Q That is good enough, 4.4?

A I understood you to say 5.4.

Q No, I said 4.5.

A I beg pardon.

Q At least, I think I did. That leaves us with 4 trillion, doesn't it? 4.4 subtracted from 8.4 leaves us 4 trillion to supply all the other demands of the Province?

A For 30 years.

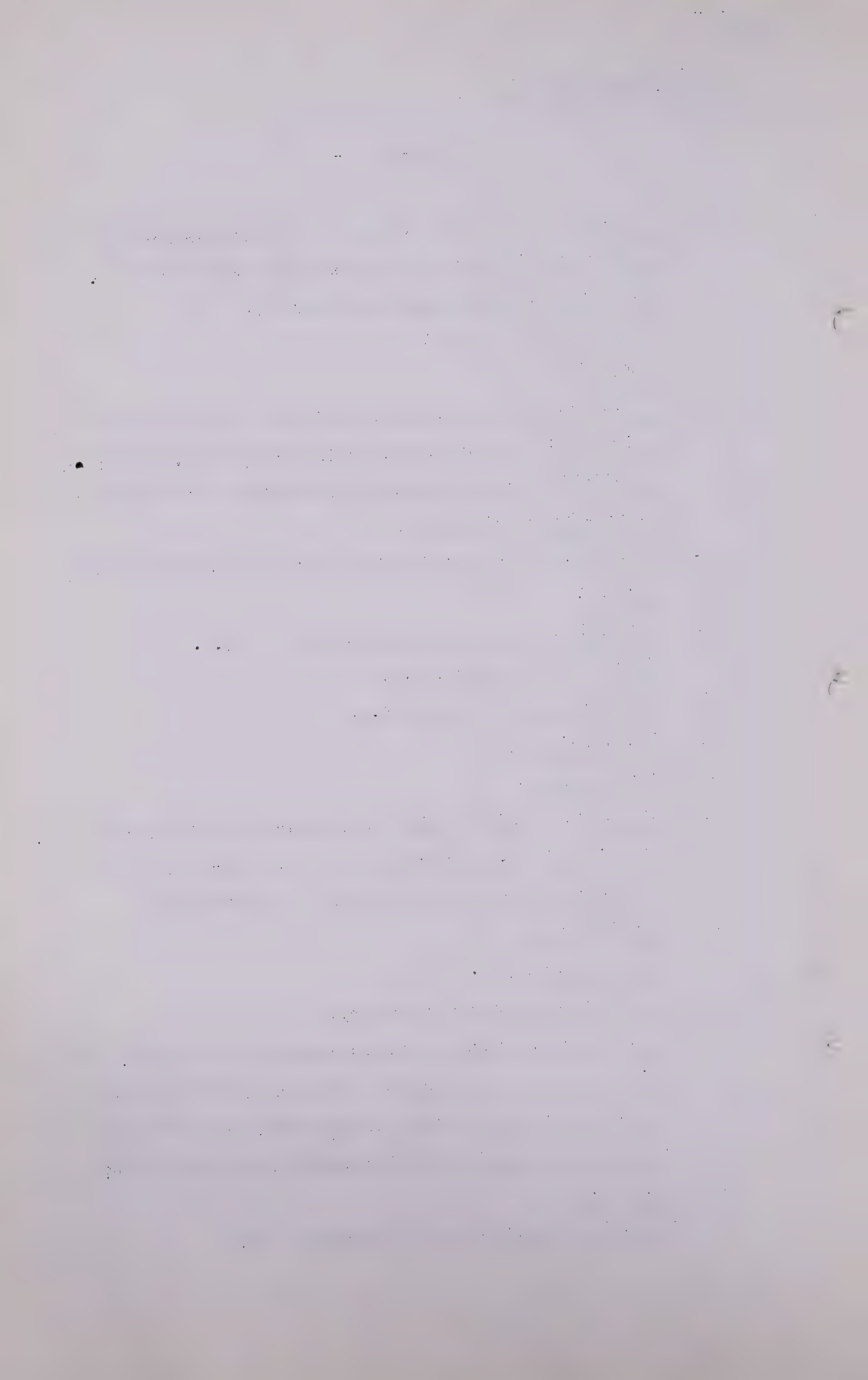
Q For 30 years, yes.

A Yes, without another discovery.

Q Yes, and we go back to our fundamental difference, the opinion as to the extent to which the Board ought to speculate on these future discoveries, and you and I cannot gain anything by discussing that any further?

A No, sir.

Q Pakowki is about 500 billion cubic feet?





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A Something in that general order.

Q I wonder if you would take these figures down. 500 billion cubic feet.

A What do you define as the Pakowki area, Pakowki or the Pendant d'Oreille field?

Q The Pakowki area. I am talking about the area which is to some extent committed to the Montana Power Company by reason of their permit to import 4500 billion cubic feet.

A I am talking also -- that would be Pendant d'Oreille, Manyberries and Black Butte?

Q Yes, everything claimed by you or proposed by you for Trans-Canada. I suggest to you there is about 500 billion cubic feet there?

A I think so, yes, sir.

Q And 823 billion cubic feet in Medicine Hat?

A Yes, sir.

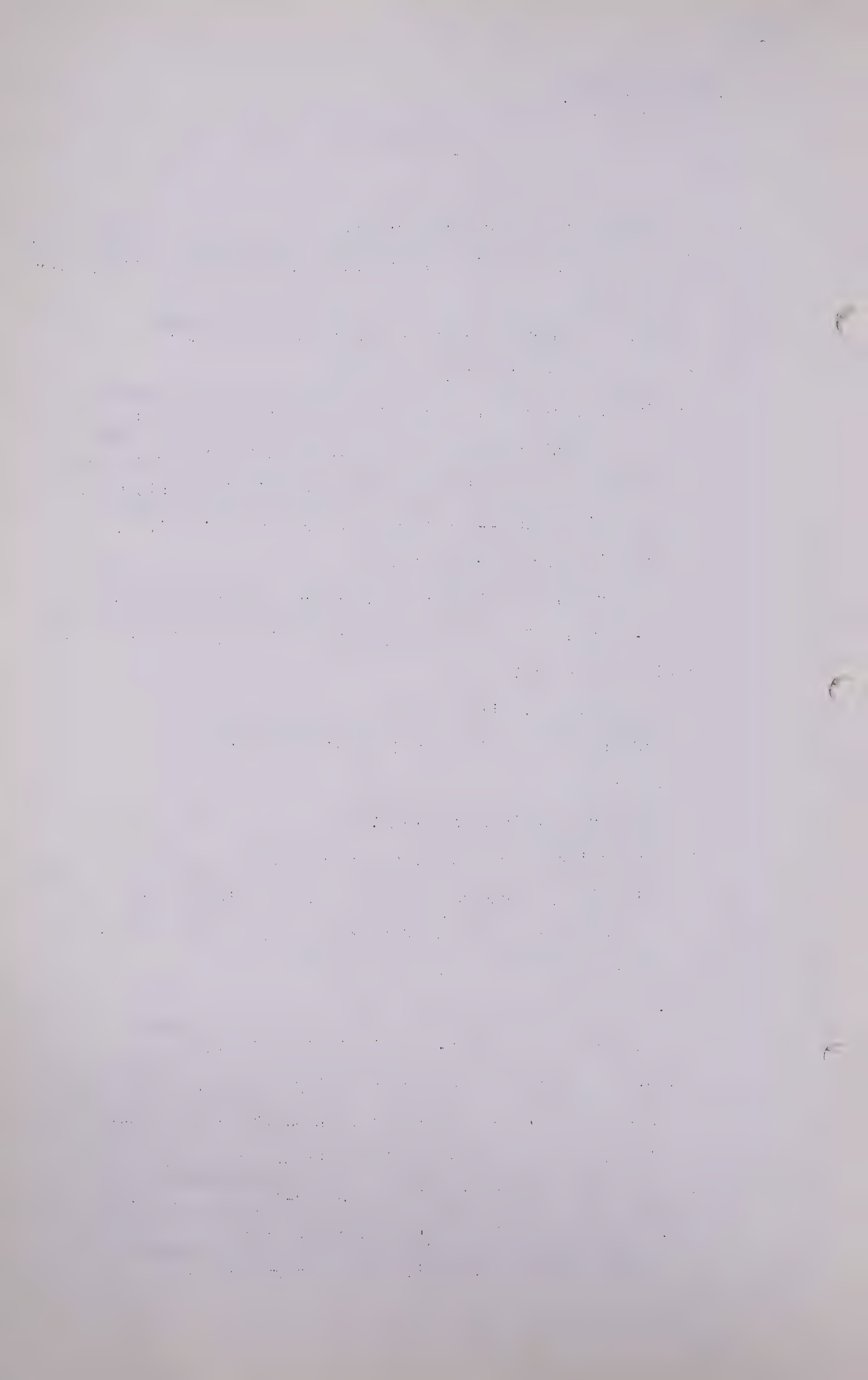
Q 24 billion feet in Bow Island?

A I am assuming your figures are correct?

Q Yes, I think you can assume it. I would like you to check it perhaps overnight and if there is anything wrong with them perhaps you could let us know?

A Yes.

Q 32 billions in Foremost. 540 billions in Jumping Pound. 366 billions in Turner Valley. 743 billions in Viking-Kinsella. 525 billions in Leduc-Woodbend. That 525 is made up by deducting 313 billion of associated gas from the 838 billion in the Leduc-Woodbend area. Now, then, those figures I am suggesting to you can roughly, at any rate, be described as gas committed



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already to various undertakings in the Province. I am suggesting to you Pakowki -- we have discussed that. Medicine Hat is committed. Bow Island is committed. Foremost is committed. Jumping Pound, and so is Turner Valley and so is Viking-Kinsella and so is Leduc.

A I am not sure that I could agree that all is committed. For example, Medicine Hat, I do not know.

I see.

A There is a very large area there and whether you want to consider the local distribution system as having a call on that gas for eternity, I do not know. That is beyond my province.

Q Let us assume for this purpose that is so. I am suggesting to you that the total of those figures is 3 trillion 351 million cubic feet?

A It looks as if it would be in that order.

Q 3 trillion 351 billion cubic feet. Now if that is so and you take 4.5 trillion proposed for Trans-Canada and this 3.2 trillion which is already, as I suggest to you, committed one way or another, you have got 7.7 trillion, haven't you?

A That totals 7.7 trillion.

Q Yes, out of 8.4 trillion total reserves and that leaves a difference as of today to supply the 2 trillion-odd which the Board has found that these distributing companies in Edmonton and Calgary require . . .

A I do not follow that.





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Q Well, let us say 8.4 trillion is your estimate of the total reserves as of today.

A I think we might get at it in this fashion -

Q Oh, no, get at it in my fashion, please.

MR. PORTER: Just a moment. Surely this witness can get at it in any fashion he likes. This does not happen to be a school room.

MR. STEER: Certainly I am as long as he answers the questions. The Board will tell the witness to answer the questions instead of -

THE CHAIRMAN: Would you mind repeating the question, Mr. Steer, or have the reporter read it over again.

BY THE REPORTER (reading): "Q. Well, let us say 8.4 trillion is your estimate of the total reserves as of today. A. I think we might get at it in this fashion."

Q MR. STEER: Now, we will get at it in this fashion, Mr. Dougherty, if you do not mind.

A Yes, sir, I will attempt it.

Q 8.4 trillion is your estimate of the total reserves of the Province as of today?

A Available for sale, yes, sir.

Q Available for sale. 4.4 trillion is what you propose for the Trans-Canada pipeline?

A These fields have that total amount of gas. Whether that is to be taken out is another matter.

Q Whether this is a proper inference to be drawn from your report or not, and your evidence, we will assume



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it is the proper inference to be drawn, That perhaps  
will be a matter of argument if it has to be argued.

4.4 trillion proposed for Trans-Canada. Now, that leaves  
4 trillion, doesn't it?

A Yes, sir.

Q All the gas in the Province?

A Yes, sir.

Q And 3.2 trillion is the sum of the figures I gave you a  
moment ago?

A I thought it was 3.351.

Q 3.3 trillion?

A Yes, sir.

Q All right, I am sorry. 3.3 trillion, and I am suggesting  
to you that if you deduct 3.3 trillion from the 4 trillion  
you have got .7 trillion cubic feet, that is right?

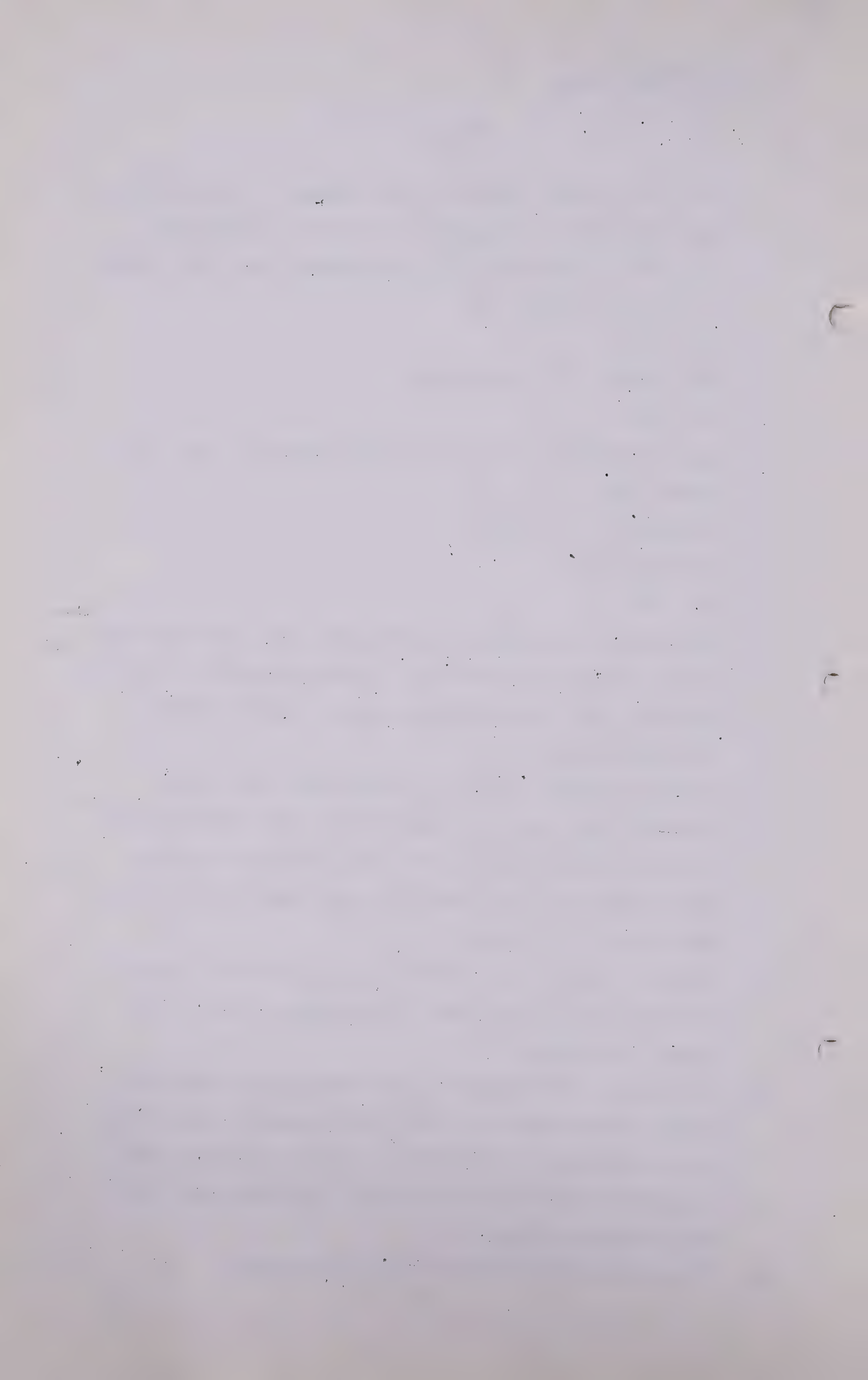
A That is correct.

Q And I am suggesting to you further that out of that .7  
trillion feet has to be found 1100 to 1300 billion cubic  
feet for Edmonton and 1100 to 1300 billion cubic feet  
for Calgary which the Board has said has to be found over  
the period of 30 years?

A I do not follow that because I do not have any figure in  
here relating to the market requirement. What is the  
market requirement?

Q You do not need figures, I am suggesting to you, as to  
market requirements to answer that question. The Board  
says that these two systems require 2.2 trillion cubic  
feet additional reserves over and above what they have  
at the present time.

A Over and above the Board's reserve estimate?





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Q Over what they have at the present time, over what the Board estimates that they have at the present time.

A Well, I think we must get a standard of reference either to my reserve figures here to make the subtraction, you see, because some of the 1.1 or 1.2, whatever it is, is already in these figures you subtracted of 3.3. You see, Viking-Kinsella and Jumping Pound are tied to the Calgary system.

Q I am giving you these figures of committed reserves, as I choose to call them, of 3.3. Those are your figures?

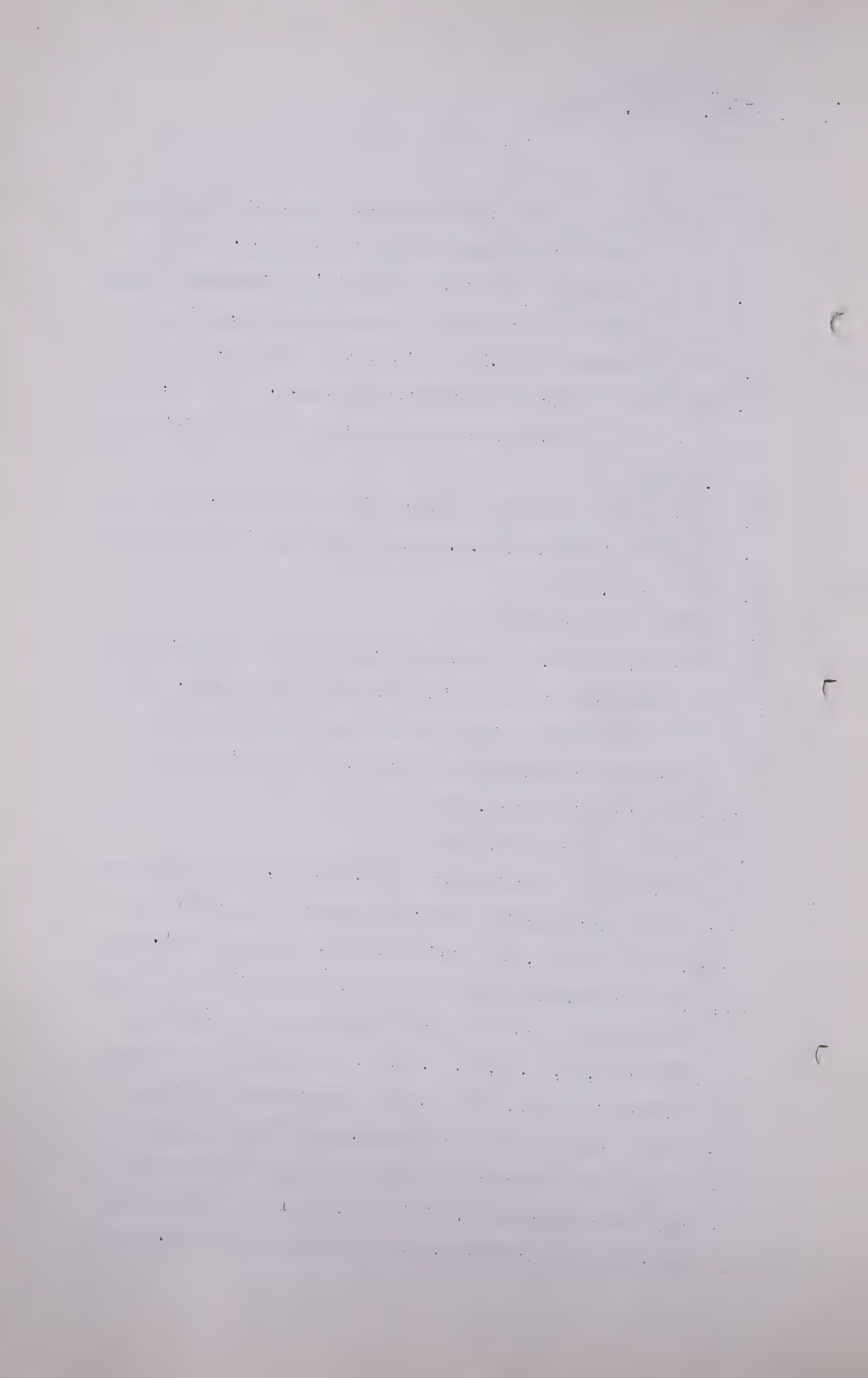
A That is correct.

Q Those are your figures?

A Except the 1.1 and 1.2 have a different reference than my estimates. If you bear with me just a moment, sir, what I would like to do is find out what the total requirement estimated by the Board was for the two Utilities of the Province.

Q Have you the report here?

A On page 59 of the Board's submission, line 7, the Board estimates the Province's requirement for the 30-year period, 1951 to 1980, as 3 trillion 059.9 billion feet. Now, my understanding of the figures would be that you have summed up a total of 3 trillion 351 billion in those fields 1, 2, 3, 4, 5, 6, 7, 8, which is in excess of the 3 trillion 059.0 or 06. as shown by the Board as the requirements of the Province. Then we would have in addition another 700 billion which would make our full total there of 8.4 trillion, so I can not see any deficiency reserve-wise. If we start out with 8.4



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in the Province, taking out 4.4 for Trans-Canada, it leaves 4, and the Board's figures give 3.060 as the requirements. We then would have a surplus above the Board's requirements by the difference measured between 4 trillion and 3.060 trillion.

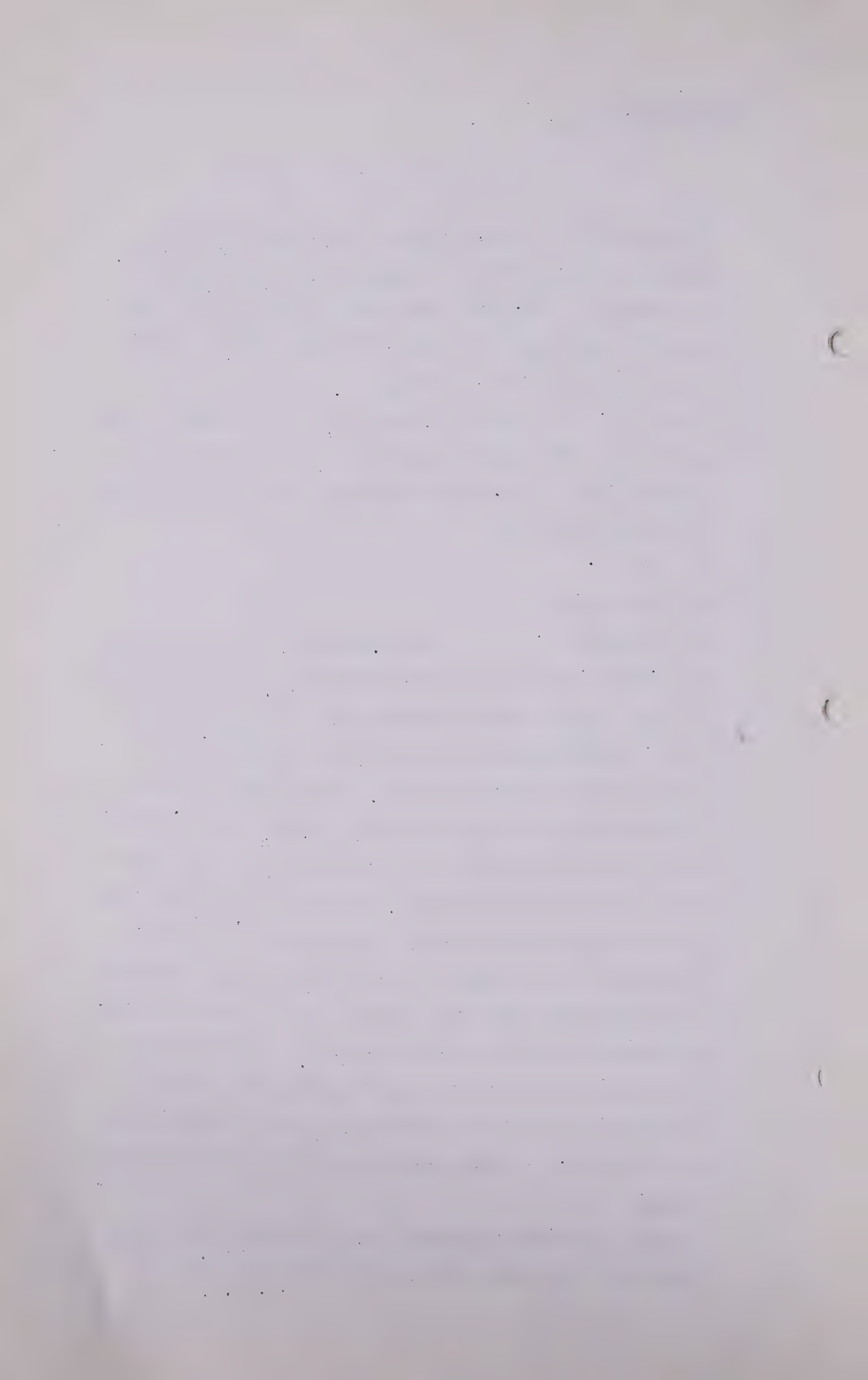
Q I see. If I am right, however, using your figures only, and if the Board should find that it requires over the next 30 years 2.2 trillion additional cubic feet of gas, it is not available?

A No, sir.

Q On your figures.

Q THE CHAIRMAN: Mr. Dougherty, I think you and Mr. Steer are going at cross-purposes. Your figure that you are quoting here is actual sales of gas, you might say, or requirements of gas without considering the deliverability factor at all. I think what Mr. Steer is getting at is over and above the present reserves of the Gas Company, to maintain the deliverability they require those extra reserves of gas. The figure, I think, that you are using is the actual requirements as the Board set it out in the number of feet that will be consumed, but I think you will find further on or somewhere there it states in order to produce that 3.2 trillion feet of requirement the Board felt there would be about 4½ trillion cubic feet of reserves required to make that gas available. I think you are talking of two different things.

A I think our reference point has been different. There would be a deficiency if you use that 4.5, 4.4.





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Q MR. STEER: Used which?

A The 4.4 which Mr. McKinnon referred to. However, I do not find that figure.

Q DR. GOVIER: Page 59, paragraph 8.

A Which paragraph, sir?

Q 8.

A  $4\frac{1}{2}$  trillion cubic feet. If you wish to make the subtraction you will find a deficiency but these reserves we are showing here have not taken into account deliverability. That is a separate study which Mr. Trostel introduced.

Q MR. STEER: We will, perhaps, have to wait for that but I am suggesting to you that if you require 4.4 trillion for Trans-Canada, and if there is already committed gas in the Province of 3.3 trillion, and if the Board is right in saying that the Gas Companies require 2.2 trillion over the next 30 years, it is obvious that there is a deficiency on your figures?

A Well, I can not agree with that, due to the little basic difference there in the standard of reference for those figures.

Q You are capable of making assumptions, Mr. Dougherty, and I have asked you to assume that the Board has proved that the Gas Companies require 2.2 trillion, and I have shown to you that there is committed gas of 3.3 trillion, and you have shown me that Trans-Canada proposes to take 4.4 trillion, if you add them all up you get a lot more than 8.4?

A No, sir. Let us start this way, let us take the  $4\frac{1}{2}$



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trillion which the Board says -

Q Just a moment. I have asked you to make an assumption.

MR. PORTER: How would it be if we just let  
the witness answer.

THE CHAIRMAN: I think the witness should  
answer it, Mr. Steer. I think it is hard for him to  
answer. I think you should at least give him a chance  
to explain his version now.

MR. STEER: Very well, sir.

A I will start with this statement, we estimate 8.4  
trillion feet of gas available for sale in the Province.  
We estimate that the reserves now proposed can supply the  
needs of Trans-Canada for a total reserve available for  
sale in the order of 4.4 trillion. The subtraction  
leaves 4 billion feet. If we then compare that with the  
Board's statement on page 59, line 8, paragraph 8,  
"The Board considers that in order to meet the deliver-  
ability of the aforementioned requirements, namely,  
3 trillion feet, that established reserves in the order  
of  $4\frac{1}{2}$  trillion cubic feet are required." We would then,  
on the basis of having 4 left by subtraction from 8.4,  
4 trillion to compare with the Board's suggested  $4\frac{1}{2}$ .  
The difference would be half a trillion.

Q That is all right.

A I think that gets us into phase on all the various  
estimates in the statement.

Q Quite so. That is quite all right.

A Purely on a reserve basis, not on a deliverability basis.

Q Now then, to get this gas that you propose should go to





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Trans-Canada, you have included first of all the Pincher Creek gas which they have?

A As proposed, yes, sir.

Q And 8 fields in census division 3, Princess, to which you have assigned a proven reserve of 67, 194 million cubic feet?

A Yes, sir.

Q And Brooks Northeast to which you have assigned 30,096 million?

A Correct, in the proved category.

Q And Countess 64,909 million?

A Yes, sir.

Q Then you include 5 smaller fields?

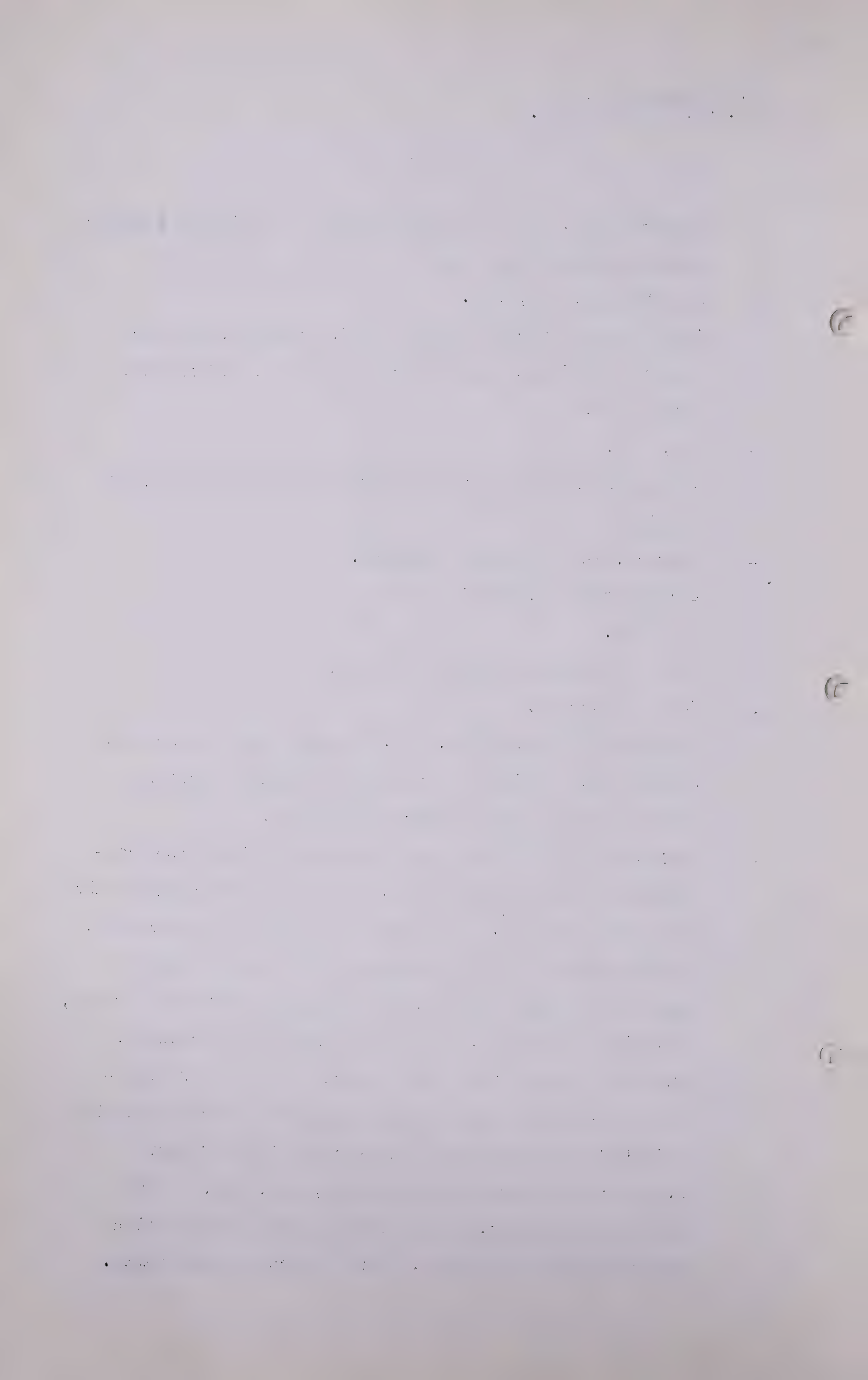
A That is correct.

Q You told us Rainy Hills, etc. I would like to ask you whether you consider the 5 smaller fields as having reserves which would attract a pipeline?

A They are within a very short distance of the trunk compressor of the proposed line. I see no difficulty at all in picking this up. I would like to make this addition, in our studies we also included the probable reserves shown in the next problem, not limited only to the proved, established reserves, the sum of proved and probable.

Q You would not say then with regard to these 5 fields - do you think drilling would be required before you would be justified in gathering those quantities of gas?

A Oh, you could start gathering them, yes, sir, if the well were completed. Some of them are prospects with perforating not completed. Some are capped gas wells.



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Q We are talking about gathering those wells today and I am asking you whether in your opinion further drilling would be required in the case of those 5 smaller fields?

A Oh, yes, sir. Yes, sir.

Q Before anybody would be justified in building a pipeline to gather them?

A Well, I do not know, using that phrase "nobody". I say it would have to be someone who would want to take the gas for their pipeline, would be able to get a dedication or commitment from the owner of the land and he would then drill the wells. I do not quite follow.

(Go to page 409)





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Q I would ask you whether a prudent pipe line operator would construct a pipe line to these five smaller fields as of today?

A I think that if part of his over-all long-time plan, yes, sir.

Q If which?

A If it is part of his over-all, long-time plan for the gathering of gas, yes, sir. He might not do it today; it might be two years from now. Time does not enter into the estimate of these reserves. That is a function of the availability and the build-up on the pipe line requirements wherein all of the physical problems relating to production and development will be dovetailed, and you cannot sit here and plan down to the nth degree with regard to the structure as presently set up. It is impossible.

Q Would you recommend a prudent pipe line operator to gather this gas from these five small fields, as they are known today?

A I would make it part of their over-all system, just as we have included here.

Q How many miles of branch pipe lines should be put into a field having 10 billion of reserves?

A That is not part of my study.

Q Is it part of your experience?

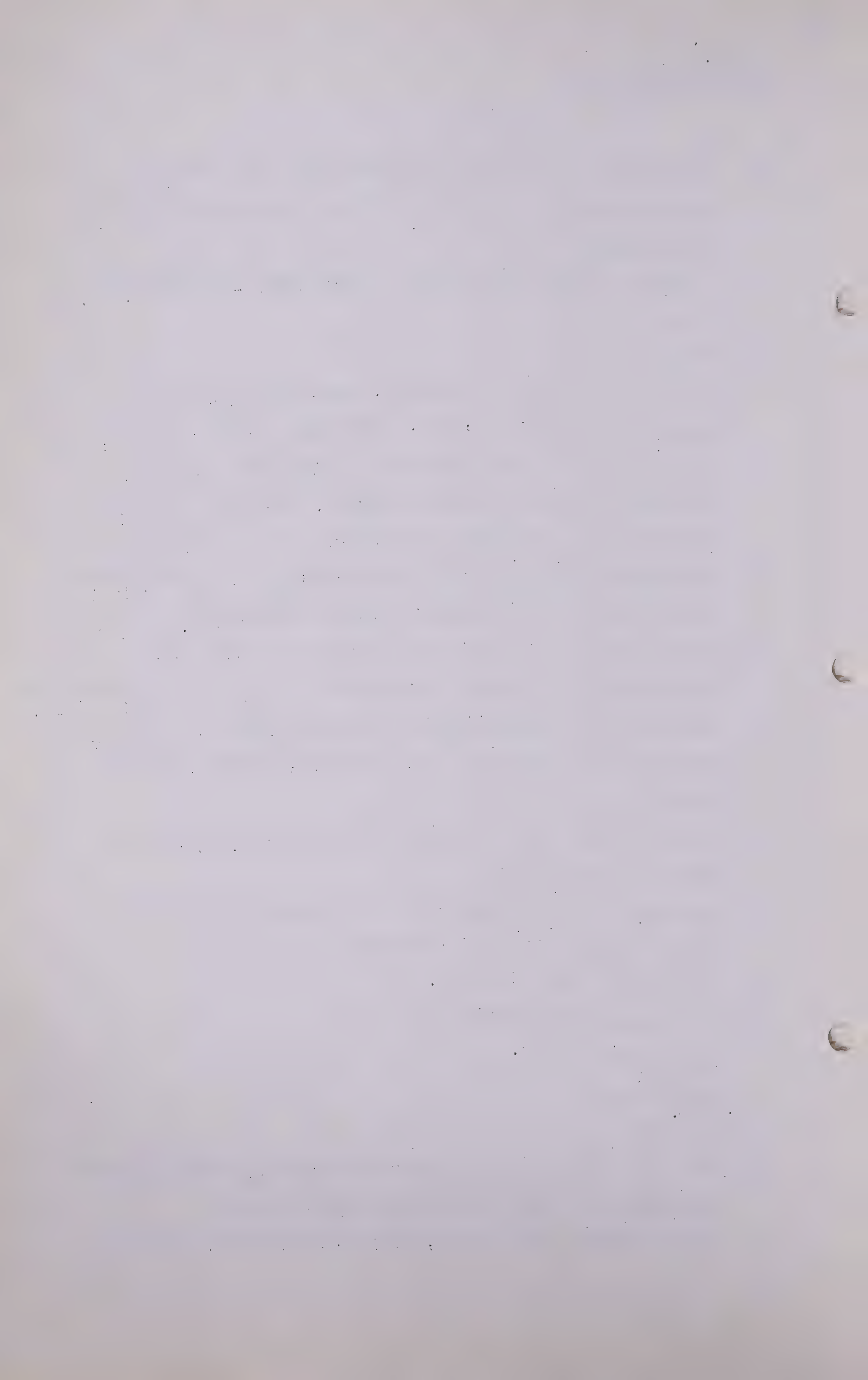
A Not directly, no, sir.

Q Indirectly?

A No, sir.

Q Have you any idea as to what length of pipe line a reserve of 10 billion cubic feet of gas would justify?

A All by itself out in the woods, or in connection with an



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integrated gathering system?

Q Out by itself in the woods?

A I do not think that is a practical question.

Q I see. I am not going to suggest to you that if you have a reserve of gas that is going to endure over a period of, we will say 20 years, I mean, I am going to suggest to you that a reserve of 10 billion cubic feet, if it is a reserve of 10 billion cubic feet, that it would justify a mile of pipe line?

A It is quite possible.

Q I am going to suggest to you that that is the yardstick used by the Tennessee Gas Transmission Company and the Trans-Continental Gas Pipe Line Company in Texas. Do you know that?

A Well, it is interesting.

Q You do not know that?

A No.

Q I see. In Census Division 8 you have included four fields we have talked about, and none of those fields had as much as 20 billion cubic feet of proven gas?

A Yes, sir, Bashaw has 26.

Q I am going to ask you, that being so, whether more drilling would be required there to make these smaller quantities available?

A We had more drilling forecast for every single field which has been proposed is to be connected to Trans-Canada.

Q Yes.

A Until the field is developed on a reasonable basis, and there is testimony and considerable detail that Mr. Trostel is going to give with regard to each of these fields and the





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availability from each individual well.

Q Perhaps we had better leave it?

A Yes, sir. I am responsible for the reserves.

Q Yes. On your allocation of reserves, and perhaps you would want Mr. Trostel to answer this question, on your allocation of reserves available to Trans-Canada, you have included 313.6 billion cubic feet from the Lower Cretaceous in the Leduc-Woodbend Field?

A Yes, sir.

Q I am going to ask you, regardless of the accuracy of that estimate, the local situation being what it is, and the gas being 20 miles from Edmonton, do you think it ought to go to the Edmonton system or do you think it ought to be exported?

A We have shown it as a proposed gas supply field.

Q For export?

A Some time. If, in the meantime....

Q Now, you prepared, Mr. Dougherty, as a man experienced in the gas business, I take it that you are, and you have 313 billion cubic feet within 20 miles of Edmonton, which requires additional quantities of gas, do you think the Board should give a permit to export that gas rather than see that it supplemented the Edmonton requirements?

A I cannot determine that because I do not know the position of the Board or the position of the holder of those gas rights. He might not be too happy about having his revenue deferred for 20 or 30 years. I think there is a very complex problem in equity behind all these determinations, and I do not propose to answer that.

Q There is not any necessity of deferring the production of



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this gas for 20 years, is there?

A There may be.

Q Well, is there?

A If the utility in Edmonton is going to tie on to all the reserves in the vicinity, some of necessity will be deferred. My understanding is that the deficiencies do not occur for a few years.

Q Yes?

A So that someone is going to hold it without any revenue for some time.

Q Yes?

A Which complicates the thing considerably.

Q Yes. But other things being equal, I think you would say, wouldn't you, that this 313 billion cubic feet and the reserve of the Legal-Morinville area 14 miles from Edmonton, would normally be used to supplement Edmonton's supply?

A I do not know. That goes into a very complex economic problem as to how much gas should be sat on indefinitely without any revenue accruing to the holders of the gas rights.

Q And you leave that economic problem in the lap of the Board, and you are not able to give the Board any assistance?

A I certainly cannot. It is a very complex problem.

Q I want you to look at the Viking-Kinsella Field, if you will?

A Yes, sir.

Q The acreage that you computed in that field is what?

A On page 3, Census Division 10 of Exhibit 10, line 4, we have estimated proved productive acreage to be 496,806 acres, and the possible acreage productive as 683,300 acres.





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Q Now, it is not going to be possible for me to go through all of the fields with you, Mr. Dougherty, but I would like you to tell me if, at the outset, whether your method of computing acreage in the Viking-Kinsella Field is the same as you used in all of these other fields where you have computed acreage?

A It is a variant of it, that is true. None of them are exactly the same.

Q I do not know what you mean by that. Did you follow the same principle?

A Yes, sir.

Q Pardon?

A Yes, sir.

Q Yes, that is all I wanted to know. In other words, your computation of acreage in the Viking-Kinsella Field indicates your method of computation, or your method of computation indicates to us the principles that you followed in your computation of acreage in all other fields?

A Some of them. Some principles, not all. That would depend upon the field.

Q The ones that were applicable?

A To the particular fields, that is correct.

Q Let us assume for the moment that you draw your proven line in the Viking-Kinsella Field within a certain distance of a well - perhaps I will put it this way: You draw your line indicating the proven area in a certain way as between a producing and a dry hole?

A I do not so do.

Q Pardon?

A I did not so do.



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Q You did not so do?

A No. It is more complex than that. It is not that simple.

Q I see. If you have to determine what area between a producing well and a dry hole is to be included in your proven area, what do you decide, what do you look for besides the distance between the two?

A I would like to illustrate that, if I may.

Q Yes, if you will? Have I a copy of what you have there, Mr.Dougherty?

A No, this is a work map.

Q Of the Kinsella Field?

A Yes, sir.

Q Yes?

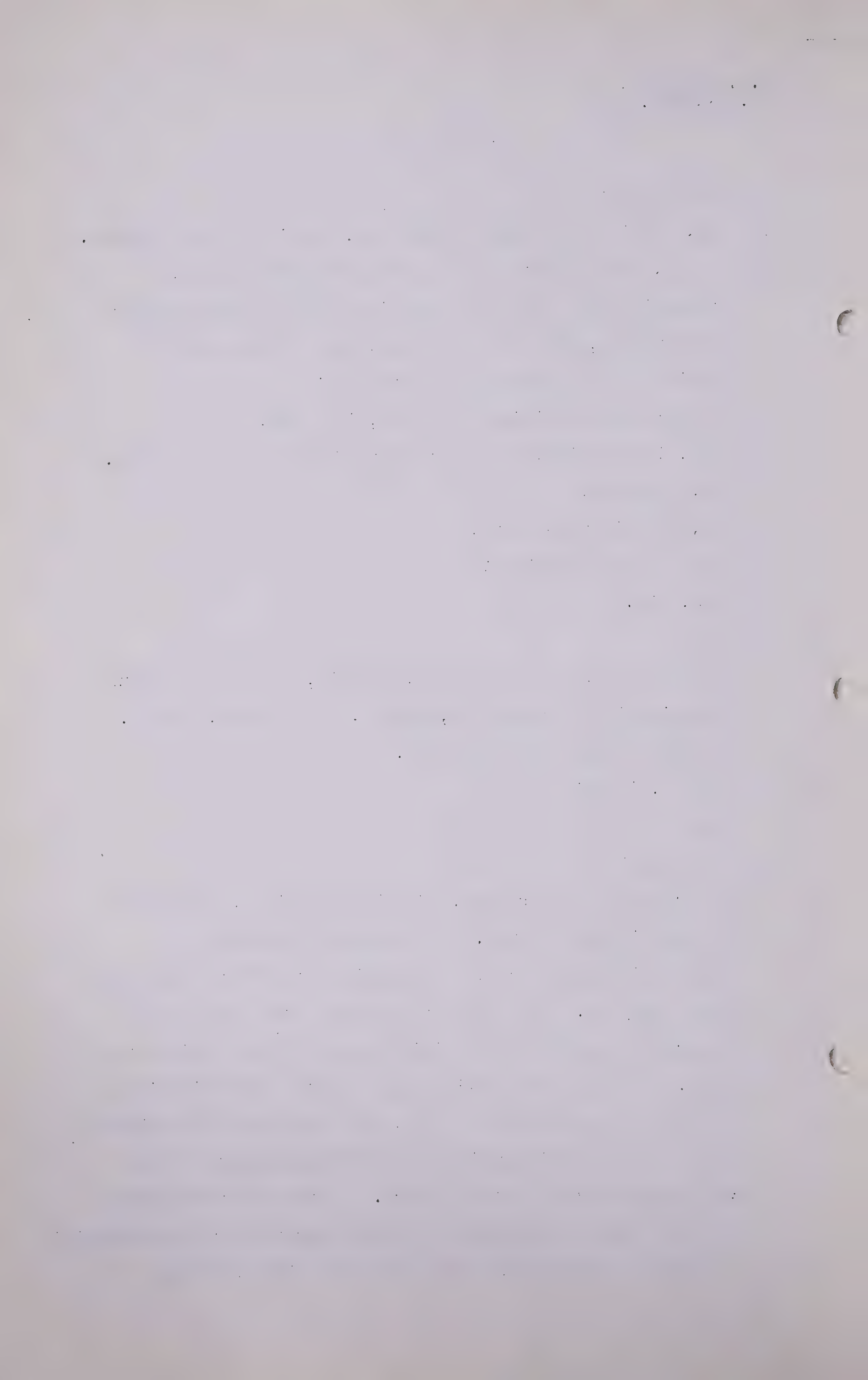
A If you will refer to the map, Exhibit, the map in Census Division 10 of Exhibit 10, page 5. I am sorry, page 6. We can use that for reference.

Q Page 5, is it?

A Page 6.

Q Very well?

A We placed on our work map, of which Exhibit 6, or page 6 is the finished result, the estimated thickness of every well that we could determine from electrologs and core analyses. We also placed every notation of the occurrence of gas in the Viking Sand over the entire map area. We then placed all of the pressure determinations in the Fall of 1950 on the map, and contoured the indicated drainage area by the projection of the gradients of the shut-in pressures as shown there. With that information we were able to determine that gas saturation in a substantial magnitude occurred well out beyond the limit shown as the





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proved limit on this map. The gas saturation was small in many cases. For example, let us take the well in Township 48, Section 8, about in the north centre of the township, well No. 12. You see the notation of 2 feet?

Q Yes?

A Estimated thickness of effective gas-bearing sand.

Q Yes?

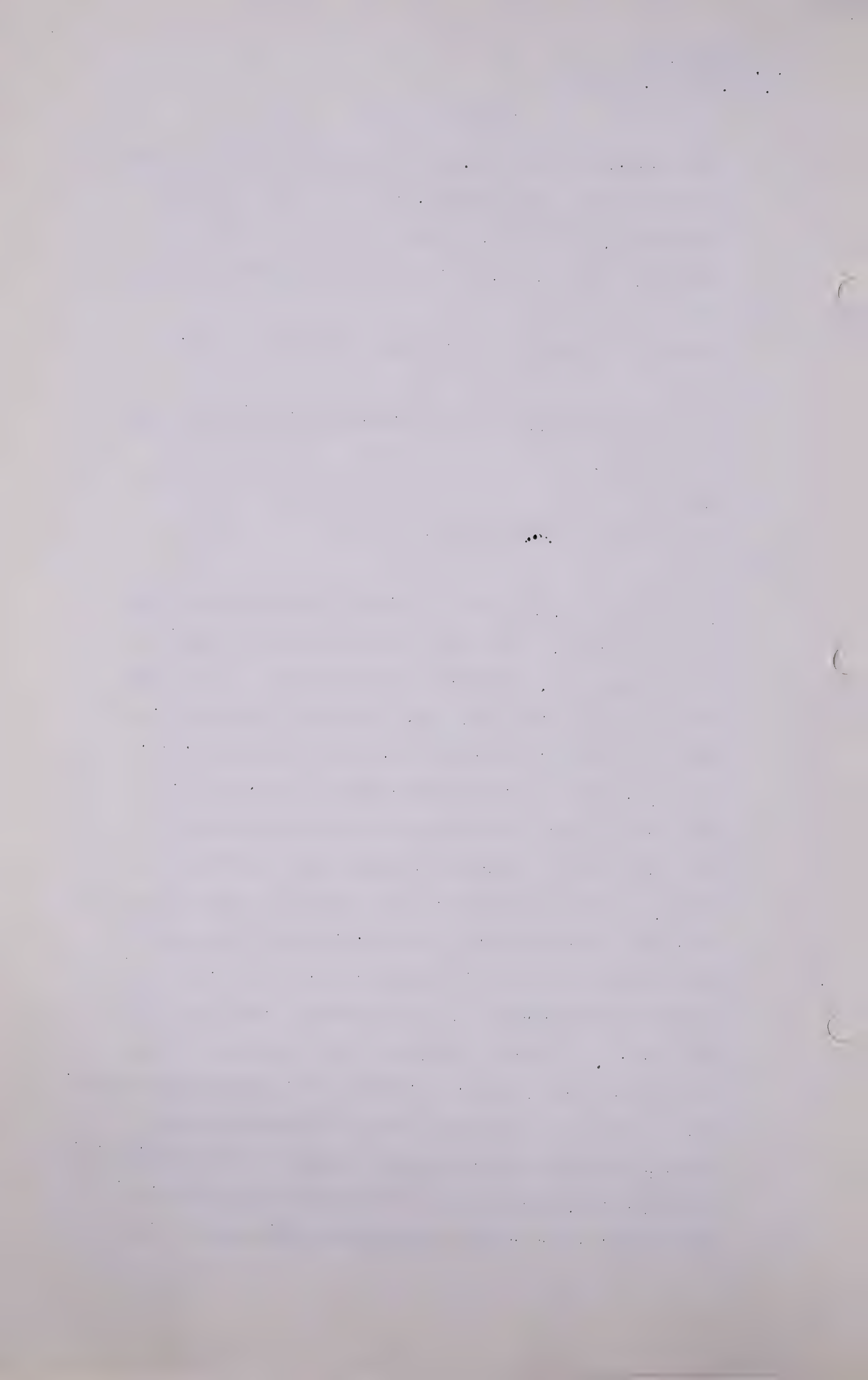
A This well on drillstem test produced 146 million cubic feet of gas.

Q Million?

A 146,000 cubic feet of gas .

Q Yes?

A In other words, we have the Viking Sand developed with gas saturation. The reservoir then extends somewhere out beyond that. How far we do not know. As we come back into the field on, say, that tier of sections, we come to a well in Township 48, Range 9, Well No. 40, with 4 feet of estimated gas-bearing sand, which, at the time of this pressure map recorded something on the order of 790 pounds per square inch absolute bottom hole. So that we know that the drainage of the gas reservoir has occurred out at least that far in the presence of the well situated in Township 48, Range 8, where it shows gas saturation in reduced volume, well outside of the limit. For the purposes of the estimate of our proved reserves, we drew our line over approximately halfway between those two wells as an approximation with regard to applying the pressure decline and the volumetric calculation, because we do not feel that we will be in substantial error in our calculation with regard to the



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volume of gas outside of that line, although in time it may be computed in some manner, perhaps in a delayed fashion, to the productivity of the field. Our whole concept is to get at the total area of gas saturation, because we did not arbitrarily limit our viewpoint to any particular portion of gas saturation or part of the reservoir. We followed a somewhat similar procedure with variations to the periphery of our proved line, depending upon conditions. For example, going down to the next township, Township 47, Range 8, we have well No. 11, in the north centre of the township, with Viking Sand developed in the amount of about 8 feet of low permeability, and indicated a small amount of gas.

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And we come inside the next township, Township 47, Range 9 to Well No. 6 in the South East corner of the Township. We found that that well tested 6.5 million of gas with some water. We feel then we have a substantial gas saturation and that we could complete our first calculation of reserves on the volumetric and pressure decline method and stay between those two wells in limiting the gas. The amount of saturation outside that line is small and will have no great bearing on our calculations. That line cannot be defined any more precisely. A similar type of analysis was made as we investigated all of the wells. We then considered the ultimate line of possible gas saturation which exists substantially miles north and east and a few miles south and southwest of the main body of gas saturation. Our interpretation shows of the wells in that area that they indicated some gas saturation and is then part of the reservoir.

Q What you have just given us illustrates the methods that you employ in determining acreage?

A That was to determine that line there insofar as we could and make a distinction for our calculation between "proved" and "possible".

Q "Proved" and "possible"?

A Yes, sir.

Q You have not got a "probable" line on this map?

A No, sir, we think that "probable" and "proved" are co-extensive.

Q That is in this area?



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A Yes, that is "probable" is in essence proved by our calculations.

Q Quite so. Of the data you have been discussing here with respect to Viking-Kinsella how much of that was obtained from the Hume-Ignatieff report.

A I do not think any except to check the well data which we have in our files. In other words, we had Mr. Beach photostat the core analyses he could find in the files of The Conservation Board and all Dr. Liesemer's notes on Viking-Kinsella field and his report going back some time.

Q I wonder if any reference was made to the Northwestern Utilities Company for access to their data?

A I think so. I am sure that Mr. Beach has talked to Mr. Patterson on some occasions. We have copies of a number of Mr. Davies' reports to the Utility and a number of other reports on the electrologs that have been released by the Utilities company to the log service.

Q You have given me Viking sand for the proven area, an average porosity of 20% and connate water content 45%?

A Yes.

Q Can you tell me how those were determined?

A We went through all the core analyses and attempted to weigh in a way we thought we could determine the average porosity for the sand thicknesses which are determined from the electrologs and the core analyses.

Q You yourself made no examination of any samples?

A No, sir.

Q Would you think that the better way of determining both porosity and connate water would be to examine the samples





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as they come from the well?

A No, sir.

Q You do not?

A There is no way of making a definitive determination of porosity by examining the sand samples. You can get a very hazy idea of whether it was loose or pliable or cemented but you cannot determine what the porosity was in terms of per cent. That is impossible.

Q Let us say you take out a core, intending to take a core of 10 feet and you get one of 6 feet and the rest of the core does not come. Suppose you found that core tight sandstone?

A That is a very hazy determination. How do you determine it is tight? That is a hard thing to do visually.

Q I see on your map that word "tight"?

A Yes.

MR. C. E. SMITH: That has another meaning.

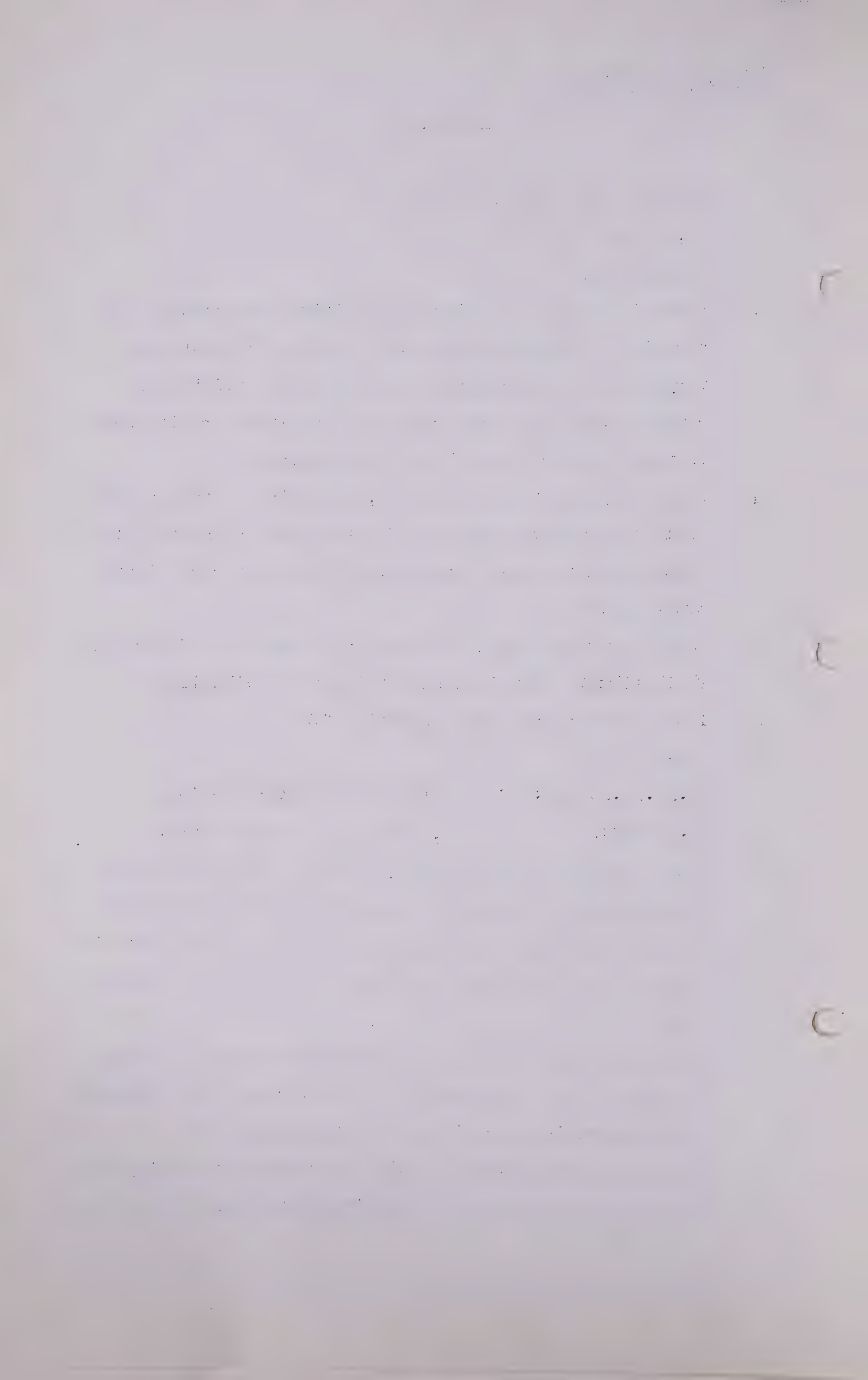
Q MR. STEER: What do you mean by that?

A That indicates when we take the drill stem test and the electrologs and we could determine in the general area the permeability and porosity but we do not know what it amounts to. We do not know whether it is 5%, or 10% or 15%.

Q What you tell us is that a competent observer, looking at this 6 feet core which I speak of, could not determine from observation that it was tight sandstone?

A He could but he could not tell you what the porosity was.

Q In order to determine the porosity that sample has to be



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subjected to tests?

A Yes, that is correct.

Q And if you did subject it to a test you would determine, am I right, the millidarcies of it?

A You would determine the per cent of porosity and you could determine the permeability as expressed in millidarcies.

Q Could you determine porosity?

A Yes.

Q It is porosity I am talking about and not permeability?

A Yes.

Q And you were going to tell me what you did. You said my idea was not practicable?

A Any visual examination could not give you any criteria of the actual porosity, or what the effective porosity is.

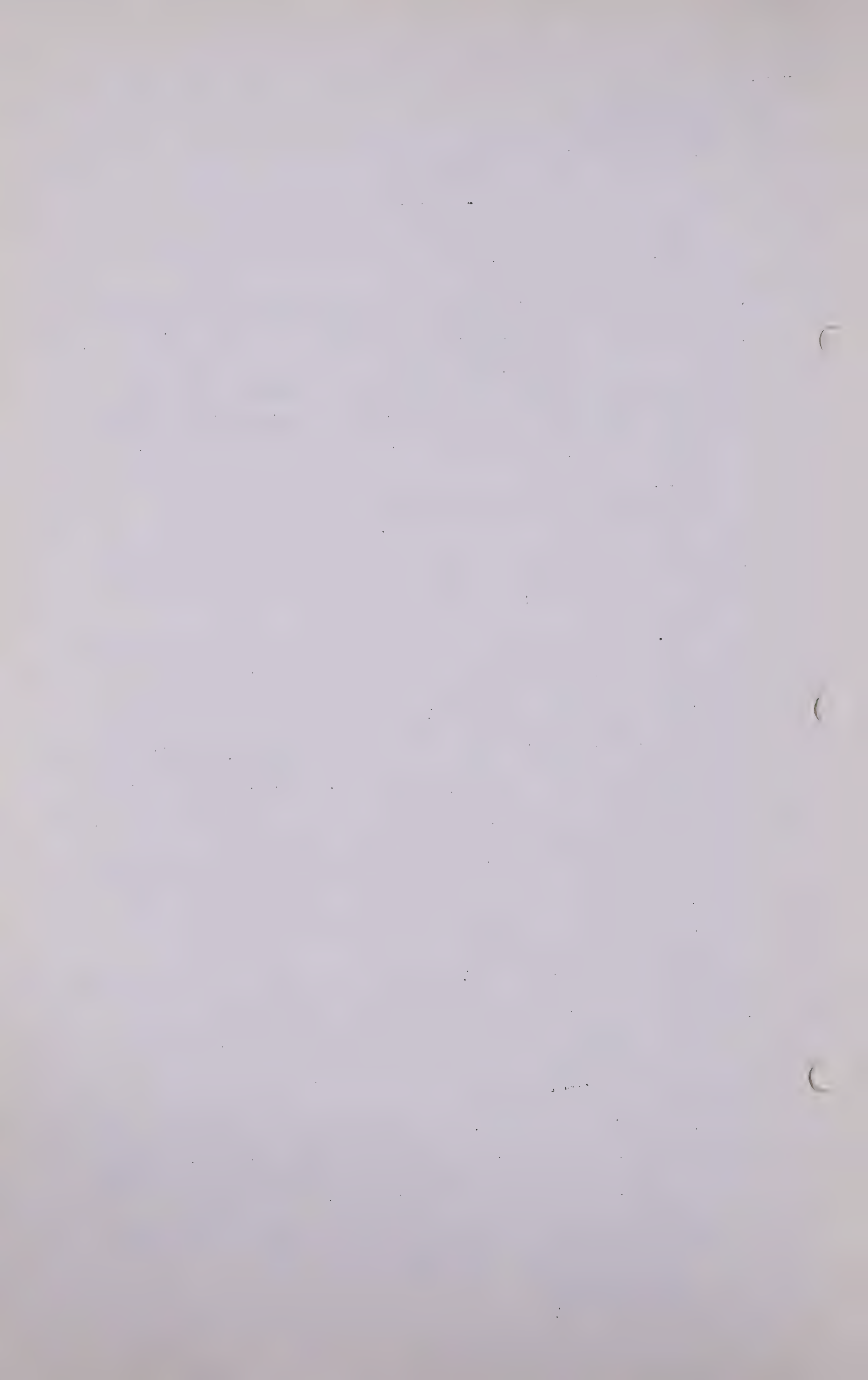
Q All I wanted to suggest to you was in the example I gave you you might say inasmuch as you did not get 4 feet of the core and you got 6 feet, indicating to the observer it was tight sandstone, you might say you had 4 feet of porosity in that hole?

A Not necessarily. I would want to examine the electrolog and I would see the electrolog characteristics of the other portion.

Q What did you examine?

A I can give you a list of all the cores of all the wells we had in our possession which formed the basis of that determination.

Q You did not have the actual cores. Did you have the core analyses?





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A The core analyses of the Madison Gas Company and the geological . . .

Q The core analyses and the well electrologs?

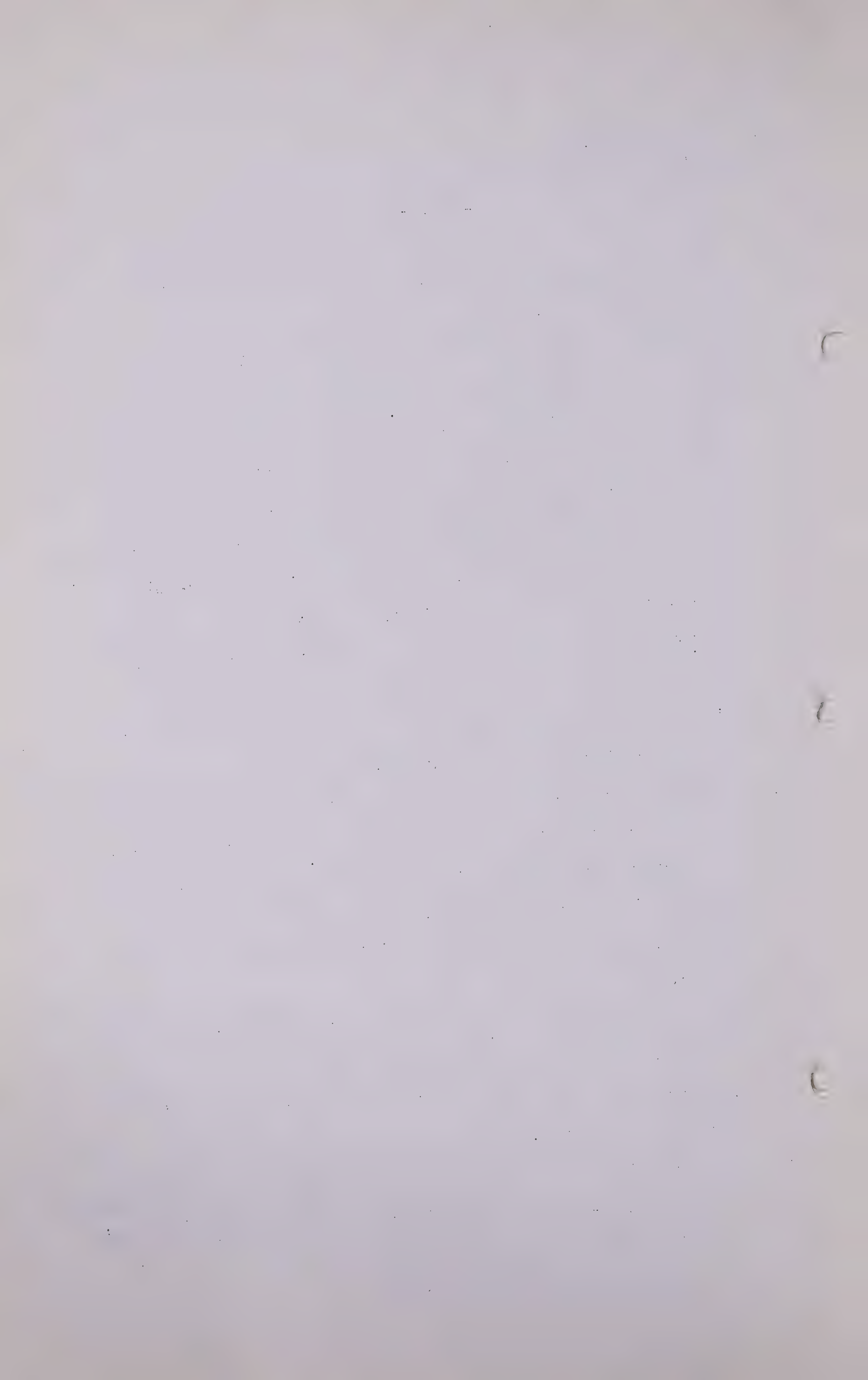
A The well electrologs and the sample descriptions of the logs and notations of Dr. Liesemer on some of the wells which were not electrologged on the amount of sand present. In our thickness map we only show those -- or the only thicknesses shown are those we could get with the cores or with the electrologs, although we did have Dr. Liesemer's determination of the sand in the old cable tool wells on which there are no cores or electrologs and no one has knowledge of the actual thicknesses in those cases.

Q It was from that material you formed your estimate as to both porosity and connate water?

A That is correct. I take the average porosity determinations and the connate water determinations to attempt to get a correct distribution of the porosity and connate water functioning. Unfortunately, the samples were limited. There are but a handful of determinations in the entire field.

Q The net effect of that was if the thickness were considered the effective average porosity was 20% and your connate water had been 20% instead of 45% your acreage would be half as much again?

A The acre feet would be. The effective pore space. The volume of gas-bearing porosity would be increased between, the difference between 45 and 25. It would not be 50%, it would be a fraction under.



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Q Approximately how much would it increase your reserves?

A It would be the difference between 55% of gas saturation and 80% gas saturation, roughly an increase of one-third.

MR. STEER: Would that be sufficient for this morning, sir?

THE CHAIRMAN: I think so.

(At this stage the Hearing was adjourned until 9 A.M.  
September 18th, 1951.)



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# The Province of Alberta

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## PETROLEUM AND NATURAL GAS CONSERVATION BOARD

Application for Permission to Remove or cause to be removed  
Natural Gas from the Province of Alberta, under the Provisions of the  
Gas Resources Preservation Act by Western Pipe Lines.

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I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

***Session:***

**Volume**\_\_\_\_\_



